THE

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WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

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GAS PURIFICATION
BY
OXIDE OF IRON.

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And Gas Apparatus of every Description.
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THE
"OTTO" GAS-ENGINE.
See Page 574.

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DRY GAS-METER MANUFACTURERS,
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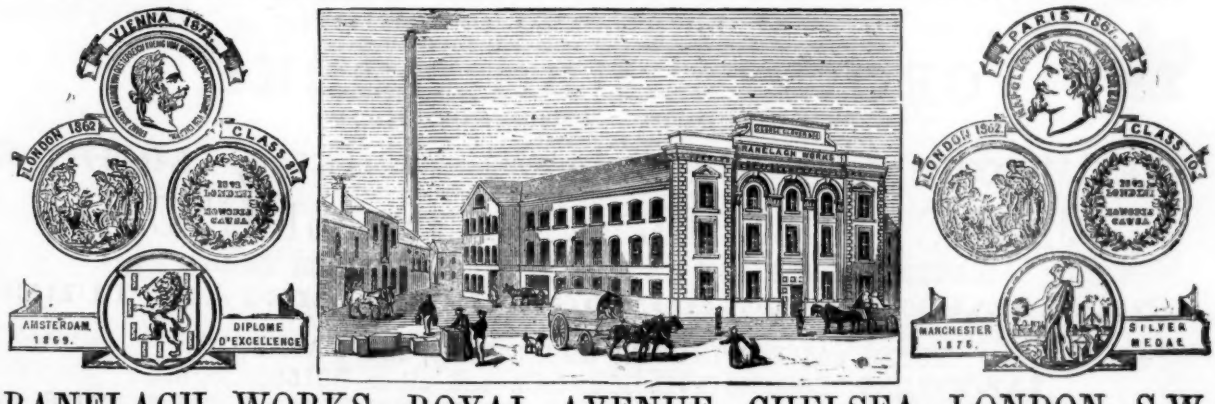

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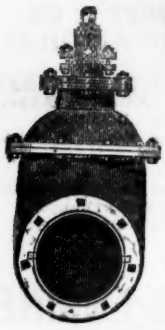
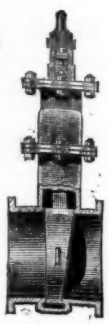


C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

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EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

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The only Prize Medal awarded for TUBES & FITTINGS.

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By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

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Near BARNSLEY.

This Company is now in a position to raise **2000 tons per day of REAL OLD SILKSTONE GAS COAL.**

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

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PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

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GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

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GAS APPARATUS;

CONTRACTORS FOR THE

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GAS PURIFICATION & CHEMICAL Co., LIMITED,

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THE WIGAN COAL & IRON COMPANY,

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Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

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(ESTABLISHED 1835.)

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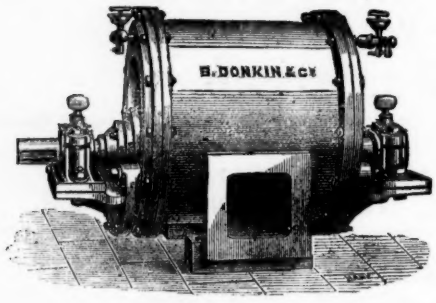
AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.



J. BEALE'S
NEW PATENT GAS-EXHAUSTERS,

For the Manufacture of which

MESSRS. B. DONKIN & Co.

POSSESS THE SOLE RIGHT.

Made with two Outside Bearings and with all the Latest Improvements.

FULL PARTICULARS ON APPLICATION.

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Messrs. B. D. & Co. are also Manufacturers of Steam-Engines and of Improved Gas and Water Valves, &c., &c.

GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.

MANUFACTURED BY GUEST AND CHRIMES,

FOUNDRY AND GENERAL BRASS WORKS, ROTHERHAM;

AND 85, SOUTHWARK ST., LONDON, S.E.

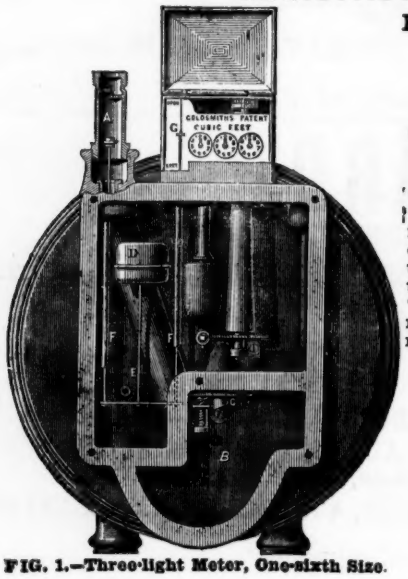


FIG. 1.—Three-light Meter, One-sixth Size.

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

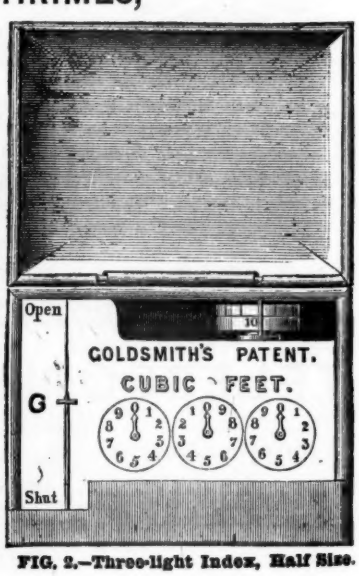
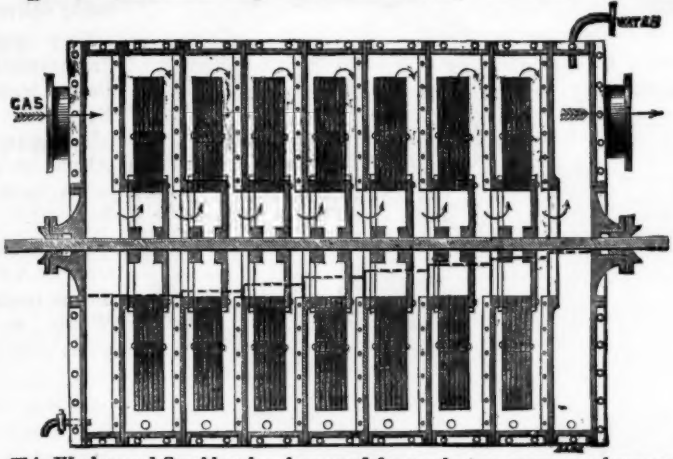


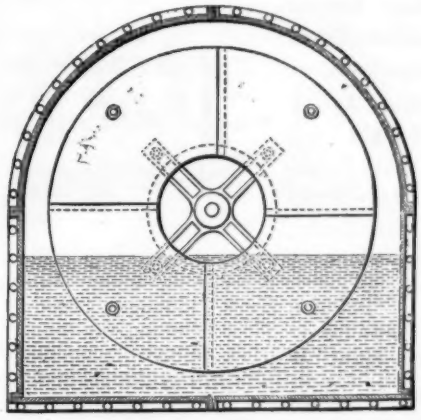
FIG. 2.—Three-light Index, Half Size.

THE

"STANDARD" WASHER & SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]





This Washer and Scrubber has been used for nearly two years on a large scale at the Works of The Gaslight and Coke Company, Bromley-by-Bow, at which station there are now several in operation and in course of construction. There is also one in use at the Pancras Station, King's Cross, of the same Company, which is purifying 1,500,000 cubic feet of gas per day. At the Gas-Works of the Corporation of Leeds, a large one has been erected, which is giving complete satisfaction. The Special Merits of this Washer are as follows:—

That it is a very effective Condenser, so that it is not absolutely necessary to reduce the temperature of the gas to 60°, or thereabouts, to make the Washer effective. That the distribution of the liquor is made with unerring regularity. That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather. That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided. That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas. That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured. That it is much cheaper than any other Scrubber that will do the same amount of work effectually. That it is the only Washer suitable for purifying Gas from all its impurities by solution. That it works with a minimum of pressure. That it takes out every trace of Ammonia from the Gas in once traversing the machine. That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

D. HULETT, Esq. *The Gaslight and Coke Company, Bromley-by-Bow, May 3, 1877.*

Dear Sir,—In answer to your inquiries respecting the results of the working of your Patent Washer, I beg to state that I find it a very efficient machine. I have had it in operation for some time, and passed gas through it continuously at the rate of 100,000 cubic feet per hour, and obtained from it 11 gallons of 10 oz. liquor per ton of coal carbonized—results which appear to me very satisfactory for so small a Washer. It works very smoothly, taking but little power, and giving no pressure. I have it still in operation, and am perfectly satisfied with its working.

I am, dear Sir, yours truly, (Signed) W. B. WRIGHT.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Leeds Corporation Gas-Works, York Street, Leeds, Dec. 6, 1878.*

Gentlemen,—The Scrubber-Washer erected by you at these works, and which has been in use for six months, has proved to be, so far as we have been able to test it, thoroughly efficient. We are at present making 32,000 feet of gas per hour, and are entirely dependent on this apparatus for the removal of Ammonia, and the **Gas is perfectly free from that impurity in the sixth chamber**, so that four chambers remain to deal with an increasing make of gas. Owing to insufficient condensers, the gas was in the summer admitted to the Scrubber at a temperature of 70°, but was reduced therein to 61°, or that of the atmosphere. The volutes are driven at the rate of four revolutions per minute, and, working at that speed, there is not the slightest difference between the inlet and the outlet pressure. Clean water supplied at the rate of 10 gallons per ton of coal carbonized is converted into liquor of from 10 oz. to 13 oz. strength **in once traversing the vessel.** The apparatus is extremely simple and compact, occupies but little space, and requires no foundation. I shall be surprised if it does not eventually become extremely popular.

I am, Gentlemen, yours faithfully, (Signed) HENRY WOODALL, Engineer.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Gaslight and Coke Company, York Road, King's Cross, Jan. 14, 1879.*

Gentlemen,—In reply to your inquiry, I am pleased to say, the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, **it takes out every particle of Ammonia**, while purifying more Gas than it was intended to do. I enclose particulars of a fortnight's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.—I remain, &c. (Signed) JOHN CLARK.

The following Table shows the results of the working of one of these Washers, lately erected to purify 60,000 feet of Gas per Hour, at the St. Pancras Station of The Gaslight and Coke Company:—

1879.	Nos. of the Divisions and Strength of Liquor in each.										Water used per Ton of Coals.	Gas Purified per Hour, Cubic Feet.	Ammonia on Outlet.	Temperature.			Pressures.		Revolutions per Minute.
	1	2	3	4	5	6	7	8	9	10				Inlet.	Outlet.	Atmosphere.	Inlet, Inches.	Outlet, Inches.	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.									
January 1	8½	6¾	5	3½	2½	1½	¾	¼	0	0	10 Gallons.	52,000	Nil.	77°	73°	48°	24	23	7½
„ 2	8½	7	6	4½	3½	2½	1½	¾	¼	0	10 „	57,000	Nil.	73°	66°	32°	21½	20½	4
„ 3	9½	8	6	3½	3	2½	1½	¾	¼	0	10 „	60,000	Nil.	75°	68°	40°	23½	22	4
„ 4	9½	7¾	6½	4½	3½	2½	1½	¾	¼	0	10 „	65,000	Nil.	74°	68°	33°	24	22½	5
„ 5	9½	7	6	4	3	2½	1½	1	¼	0	10 „	34,000	Nil.	77°	68°	35°	14½	14	5
„ 6	9½	7½	6½	4½	3	2½	1½	1	¼	0	10 „	63,000	Nil.	72°	66°	27°	24	22½	4½
„ 7	11	9	7	5½	3½	3	1½	1½	¼	0	10 „	59,000	Nil.	74°	66°	31°	25	23½	5
„ 8	9½	7½	6	4½	3	2	1	½	¼	0	10 „	78,000	Nil.	73°	61°	31°	28	26½	4½
„ 9	11	9	7	5	3½	2½	1½	1	¼	0	10 „	82,000	Nil.	74°	67°	33°	27½	25½	5
„ 10	10½	8½	6½	5	3½	2½	1½	1	¼	0	10 „	66,000	Nil.	76°	64°	28°	28½	27	5
„ 11	12½	10	7½	5½	4½	3½	1½	1½	¼	0	10 „	61,000	Nil.	75°	64°	27°	26½	25½	5
„ 12	11	8½	6½	—	—	—	1½	¾	¼	0	10 „	39,000	Nil.	74°	64°	27°	26½	25½	5
„ 13	13	10½	8½	6	4½	3½	2	1½	¼	0	10 „	78,000	Nil.	73°	65°	42°	28	26	5

Messrs. KIRKHAM, HULETT, and CHANDLER. *Corporation of Birmingham, Gas Department, Saltley Works, May 23, 1879.*

Gentlemen,—I beg to enclose you a copy of the results of the tests which, by the kind permission of the Engineer, Mr. Clark, I made on the 6th of March last, of the working of one of your "Standard" Washers and Scrubbers at the St. Pancras Station of The Gaslight and Coke Company, and I am of opinion that, for an apparatus occupying so small a space, they are exceedingly satisfactory.—Yours truly, HENRY HACK, Engineer.

Working Results obtained from KIRKHAM, HULETT, *and* CHANDLER'S *Patent "Standard" Washer and Scrubber at the St. Pancras Station of The Gaslight and Coke Company, London, March 6, 1879.*

Gas passing per Hour, Cubic Feet.	—	Impurities in Gas per 100 Cubic Feet.			Temperature.		Pressure in Inches.	Revolution of Apparatus per Minute.	—	No. of Divisions and Strength of Liquor.										Water Used during Experiment. Gallons.
		SH_2	CO_2.	Grains. NH_3.	Washer.	Air.				—	—	—	—	—	—	—	—	—	—	
64,000	Inlet	2·00	2·00	158·8	72	57	21	4½	Twaddel deg. at 60°	5·3	4·9	2·85	2·35	1·7	1·05	0·6	0·3	0·15	0·1	63
	Outlet	1·50	1·50	0·8	68	57	20		Acid, ounces.	11·0	8·4	6·3	4·5	2·7	1·7	1·3	0·7	0·3	—	

WASHER-SCRUBBERS OF THIS PATENT ARE IN COURSE OF CONSTRUCTION FOR BECKTON, BRADFORD, GREENWICH, WOOLWICH, AND SEVERAL OTHER GAS-WORKS.

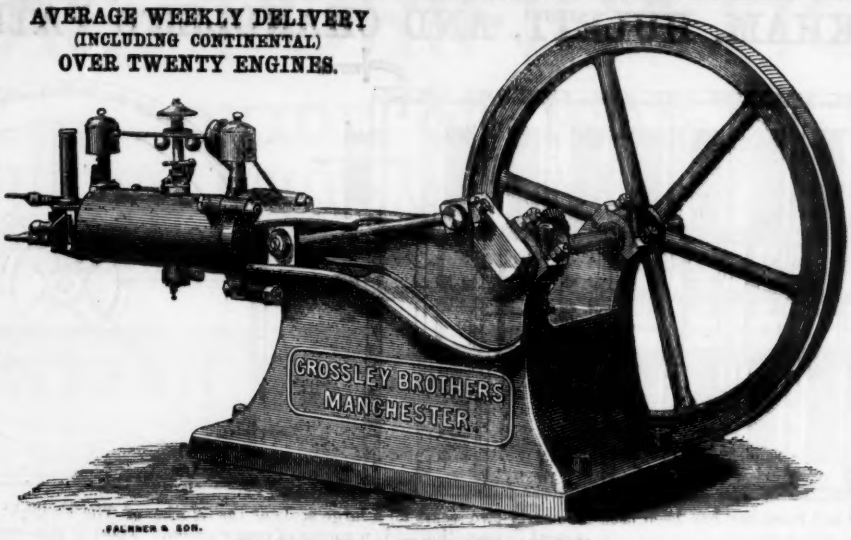
For further particulars and testimonials, address

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

AVERAGE WEEKLY DELIVERY
(INCLUDING CONTINENTAL)
OVER TWENTY ENGINES.

The durability of these Engines is now established by experience, one of them having run night and day at the Hinckley Gas-Works for over Twelve months without any expenditure for repair; this being equal to about 2½ years average work.



Over 1900 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

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(Otto and Crossley's Patents, 1876 and 1877,)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER.	SIZES									OFFERED.	CASES NOT CHARGED IF RETURNED FREE.
	NOMINAL HORSE POWER	½	1	2	3½	6	8	12	16		
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PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES).

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40 PER CENT. OF GAS SAVED.

No. A510 same as our **No. A152,**
BUT LINED WITH PATENT NON-CONDUCTOR.
Will Roast, Bake, and Fry, and with Three Burners for Boiling.

SIZE.
Outside—30in. high, 20in. wide, 20in. deep.
Inside—19½in. „ 14in. „ 17in. „

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LINED WITH PATENT NON-CONDUCTOR.
Is fitted with Roasting and Baking Oven and Four Burners for Boiling.

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No. A505.
Same as with Roasting and Baking Oven, a Broiler or Toaster, a Chop Griller, a Hot Water Boiler, and Three Burners for Boiling.
Hot Plate—26in. by 24in.

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These Cookers are jacketed, on the sides, top, and door, with a new and very efficient non-conducting material, by the use of which a **saving** of gas to the extent of **40 per cent.** is effected.

Gas Companies who are selling or hiring stoves should see these stoves. Catalogues and particulars on application to

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London Warehouses: 155a, Upper Thames Street,
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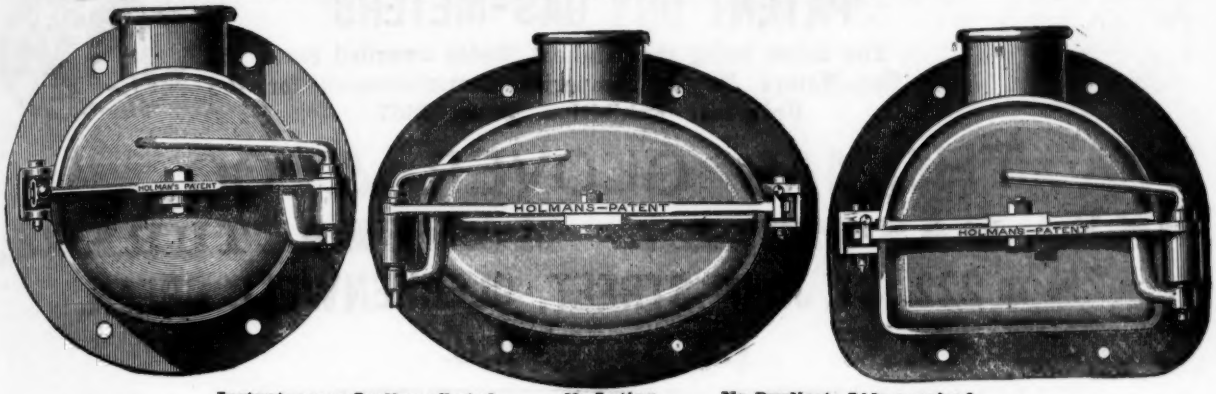
SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

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And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

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In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

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There are no working parts likely to get out of order.

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The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) JOHN JOHNSON.

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Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
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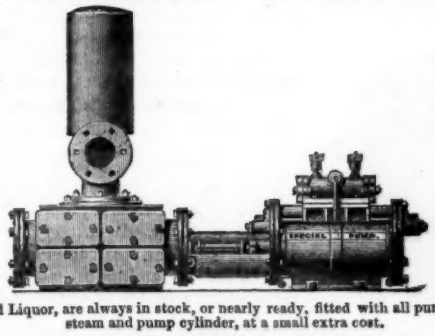
4	2	9	815	18
5*	2½	12	1,250*	21
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



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Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

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London, 1851. New York, 1853. Paris, 1855. London, 1862.

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PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

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DRY GAS-METER MANUFACTURERS,

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2nd, Are suitable for all climates, whether hot or cold;
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4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
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9th, Will last much longer than Wet Meters;
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Are upheld for five years without charge.

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(ESTABLISHED 1816.)

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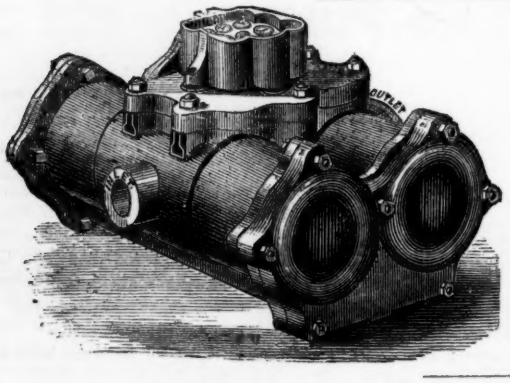
Each Meter is fitted with a ball-valve, so made that it can be adjusted to shut off the supply at the inlet when the water reaches any required height in the cistern.

The 100-gallon Meter is fitted with a cistern holding about three or four gallons, and may be fixed inside a house, free from the effects of frost, and requires no attention after once being fixed.



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The Union Water-Meter, of which an external view is here given, is of the positive class—*i.e.*, a Meter in which a measuring chamber is alternately filled and emptied, each filling being duly recorded. It is formed of two cylinders, with double pistons in each, having a rotary-valve of peculiar construction, which is worked from cams on the piston-rods.

It is claimed for this Meter, among its advantages over other Piston Meters in use, that it is extremely small and compact, and that its durability and accuracy have been proved by the fact that upwards of 20,000 of them, of various sizes, are in successful operation in the States. In England the instrument has been fully tested by several Water Engineers of eminence, and pronounced by them as a reliable and satisfactory register of water supply; it is also economical in cost.

ALL METERS are TESTED with 60 lbs. pressure before they are sent out.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 14, 1879.

Circular to Gas Companies.

We were wrong last week, in speaking of the electric light as "a half-forgotten wonder;" for, before the ink was dry, an experiment was made with the Lontin system at the Aldersgate Street station of the Metropolitan Railway. This large cavernous building, it must be confessed, is very difficult to effectively illuminate. It could be brilliantly lighted by gas, if the Railway Company would go to the expense of a sufficient quantity, with suitable lanterns and burners; but they have preferred to make an experiment with the electric light. The lamps employed are eight in number, which are supplied with electricity by a Gramme machine, driven by a 25-horse power engine nominal, the distributor making 410 revolutions per minute, and the exciter half that number. As a matter of fact, the engine was only working, on the first evening, up to 14-horse power, which was sufficient to produce in each of the eight lamps a light said to be equal to 600 candles—more or less. With the Lontin system it is alleged that the carbons, of which we gave a description when the light was first introduced outside the Gaiety Theatre in the Strand, with a Serrin regulator, will burn at the rate of three inches per hour. The cost of the carbons, and the coal necessary to drive the machinery, is reckoned at less than threepence per hour. It is not to be expected, therefore, that gas can compete at this rate; but the figures we quote require substantiation. It may turn out that, after all, good gas light might at a like cost to what is involved in the production of the electric light, furnish an illumination quite equal to that which is now said to flood the Aldersgate Street station. There is a talk that a large amount of undeveloped power lies dormant in the machinery, and this it has been proposed to utilize in lighting up the Metropolitan Meat Market. The machine now actuating the eight lights at the Aldersgate Street station is reported as capable of maintaining sixteen lights, which will have the same illuminating power as those at present in use—600 candles. About this we shall say nothing; but we turn with interest and curiosity to the experiments recently made by Professor Crookes, F.R.S., who is credited with having succeeded in obtaining, without the use of carbons, lights of small illuminating power, *in vacuo*. Each one of these lights, it is said, will have the luminosity of three candles. Thirty of the lamps, it is thought, might be maintained with an expenditure of $1\frac{1}{4}$-horse power, at a cost of less than a penny per hour. Here, it must be confessed, we have the germ, at all events, of domestic illumination by means of electricity. Mr. Crookes is not the man to rest on his oars, but he has a long and weary task before him ere he makes the electric light applicable to household service.

Further experiments in electric lighting have also been made by the Metropolitan Board of Works. We announced, some time ago, that a trial was to be made with the Jablochkoff system on Waterloo Bridge. Last Friday evening it duly came off. Ten lights were placed on circuit to illuminate the bridge—five on the western and four on the eastern side of the bridge, and one on the refuge at the Strand end. In addition to these, and in order to test the power of the machinery, five more lights were fitted up in the engine-shed at Charing Cross; thus making, with those already on the Embankment, fifty-five lights maintained by a 20-horse power engine nominal. The five lights which were in the engine-shed are intended to be utilized in illuminating the board-room at Spring Gardens, and the entrance to the hall. Since the commencement of the experiment last December, up to the 9th inst., the length of cable laid down was 17 miles 361 yards. When the Board's offices in Spring Gardens are illuminated, the total length will be about $18\frac{1}{2}$ miles. Mons. Berly, the Engineer to the Société Générale d'Electricité, intends shortly to experiment with electric candles of larger dimensions, giving lights equal to from 2000 to 6000 sperm candles, thus intending to show that the Jablochkoff system can furnish a highly concentrated light if required.

But what of all this? Is the stronghold of gas lighting in the least interfered with when we have reports such as that presented at the half-yearly meeting of the London Gaslight Company, held last Wednesday? The report of the Directors, to which we referred a fortnight ago, contains facts which are all that could be desired. They show that gas is now so largely used for purposes other than illumination, that it is quite clear electricity cannot in any way affect the amount of its consumption. The question of the Company's amalgamation stands over for the present; but it cannot be long before a decision one way or the other will be arrived at. The London Company are solicited on two sides, and, if we understand matters rightly, are offered pretty much the same terms on both. It little affects the gas-consuming public in the Company's district whether or not they enter into a combination with the northern alliance, or whether it would be better to promote a complete southern alliance. To our mind, as we have repeatedly said, the London Company should be split into two parts, divided by the Thames. The Company's district this side of the river would be fully maintained as at present. On the opposite side, where, however, the Company are now doing a good business, a large district still remains to be, and will eventually be built over, and this, when accomplished, will add largely to the profits of the Company. The Governor, in his speech, a report of which will be found in another column, made mention of the large increase in the consumption of gas during the past half year, it having been eighteen per cent. over that of the corresponding half of the previous year. This is a remarkable fact, and shows how little, after all, the electric light at present affects the use of gas. With results such as we have stated, the Company can afford to look upon the electric light with perfect equanimity. We report above two new experiments with the light, but they scarcely touch what we have all along called the stronghold of gas lighting. It must be confessed there is, in the discovery by Mr. Crookes, an approach, though only a very small one, towards domestic lighting; but the effect of this has to be verified by experience, and then we shall have to look seriously to the results of this new mode of illumination. It will not, however, affect us in the least degree. Supposing Mr. Crookes's discovery to be worked out to a success, so far as to supply a number of consumers of gas with these small lights, what would be gained? Obviously nothing at all. How many engines are to be employed, and where are they to be placed to supply light to the streets? A gas-pipe would furnish all that is required, and more than is offered by electricity, at much less cost, and engine power, with exciters and distributors, would be entirely dispensed with.

At the half-yearly meeting of the West of Scotland Association of Gas Managers, the continuation of our report of which will be found in another column, the question of amalgamation with the North British Association came up for discussion, but not for decision. Whether it is better to have one active Association, or two which hardly represent in their collective capacity the united experience of the members of both of the now existing Associations, it is for our Scottish friends to determine. There is much to be said, as is always the case, on both sides of the question. The notion that a Central Association should be formed, like a sun, around which smaller luminaries should congregate, and bring, not borrow light, is an idea well worthy of consideration; but double existences of this kind are difficult to manage. For our own part, we would advise our Scottish friends to combine their forces, and devote their whole strength to the advancement of their art. A very important paper by Mr. Hutchison, of Portrush, on "Twenty-Candle Gas for Scotland," was taken as read. Our readers will remember that some years ago, conscious, as Mr. Hutchison is, that the richer cannels were failing, and that the higher qualities of gas would not be attainable for many more years, we advocated the adoption of a much lower standard in Scotland. Our friends in the North at first seemed to fall in with the idea, but afterwards resolved that it was best to retain the highest standard they could. We still believe that they will in time come round to our opinion, and, seeing the extensive adoption of coal gas for other than illuminating purposes, will find it to their advantage to produce an article of lower illuminating power, which will better answer the purpose of consumers who wish to employ gas in some other way than for lighting. First-class cannel is now almost lost to the market. Of second-class, but little remains. Of the next class which will produce twenty-candle gas, there is still an abundance. But why burn our candles at both ends? Why should not a high-class English coal, aided by a low-class Scotch cannel, produce a gas which, while supplying a high illuminating power, will still fulfil the duty of furnishing gas for other requirements?

The half-yearly meeting of the North of England Association of Gas Managers was, last Saturday week, commenced with a very sensible speech by the Mayor of Stockton-on-Tees, who, wisely recognizing the importance of the gas industry, was still not unmindful of the more modern mode of illumination. The regular business of the Association was opened with an Inaugural Address from Mr. W. Ford, the newly-elected President, who, among other announcements of much interest to the Association, mentioned one which will be regarded with peculiar interest. It was that a sum of £130 had been placed at the disposal of the Committee, for the purpose of commencing a fund to be expended in giving prizes for the best scientific or practical papers read at the half-yearly meetings. We quite agree with the President, it is a matter for regret that all the Engineers of Metropolitan Gas-Works, and not only they, but civil engineers whose occupation lies for the most part in connection with gas undertakings, do not attend the provincial meetings of the British Association of Gas Managers. Some of them have contributed important papers at the London meetings, and, so far, Mr. Ford's accusation is not applicable. The Metropolitan members do take a vast interest in the affairs of the British Association, and if they do not contribute communications to the meetings, it is simply because they have not the leisure and time to prepare them.

The gas accounts of the Corporation of Manchester, which we published last week, show that a less gross profit was made in the year ending June last than in the previous year, although the make of gas was the largest on record—2,314,970,000 cubic feet. The consumers increased by 1·16 per cent. It is interesting to observe that the day consumption of gas in Manchester is advancing. During the past year it was in excess of the previous twelve months by 97,742,000 cubic feet. It stands to reason that the increased consumption in the twenty-four hours was proportionately higher, amounting to no less than 171,973,000 cubic feet. It is no wonder, under such circumstances, that the works of the Corporation are taxed to their utmost, and that during foggy days in the course of last winter recourse was had to short charges. The extent of the Manchester undertaking may be imagined from the fact, that the length of pipes laid and in use on the 24th of June last was 574¼ miles and 144 yards, supplying 73,886 consumers. The Manchester undertaking is, therefore, about the second largest in the kingdom. With regard to certain financial matters, the consideration of which has been postponed, we shall have something to say in the course of a week or two.

Matters are obviously improving in the coal and iron trades, but they do not improve so rapidly as some of us could wish. Prices are rising, and the demand is increasing for the best kinds of gas coal. Contracts have been made to extend over from one to three years, at rates which must be considered at the present time very reasonable, and, what is more, will turn out profitable to Gas Companies. Altogether the coal business looks highly promising in the South of England. Freights are not at an exorbitant figure, and we would recommend Gas Companies to fill up their coal stores as rapidly as possible.

Professor Williamson, of Manchester, gave yesterday week a very interesting lecture on "Coal," as one of the series of Gilchrist Lectures now being delivered at Exeter. There was nothing novel either in the facts stated or the speculations indulged in by the learned Professor as to the origin and nature of coal. That it is of vegetable origin, and that it has required millions of years to convert a pine forest into a coal-bed, we may all take for granted. To gas makers, the facts put forward were few and simple. The oldest coal, represented by anthracite, and the newest by lignite, are not the best for gas makers. Happily, Providence has so arranged matters that we have laid up for our use enormous stores of coal exactly fitted for our purpose.

Water and Sanitary Notes.

It is reported that Mr. Cross has not made up his mind about the London Water Question. We did not expect that at this early period he would be in a position to announce the conclusions he may have arrived at with reference to the subject. We know perfectly well what Mr. Cross's views portend to the Metropolitan Water Companies undertakings. They will not be confiscated, nor will the water supply of London be changed in its integral nature. We may safely say that for a long continuance of years the inhabitants of London will be furnished with water from the sources which now supply it, and the healthy condition of the population will remain relatively what it is to-day. The matter then may be left as it stands, only hoping that Mr. Cross, in considering the question, will give due weight to the circumstances of the Water Companies.

After their vacation, the Lower Thames Valley Main Sewerage Board are as forward as they were two months ago with respect to the means they should take to carry out the obligations of the Act of Parliament under which they were constituted, and which requires them to keep a large amount of sewage either out of the Thames, or to subject it to an adequate system of purification before the effluent is admitted into the river. It does not very much matter which is done, for, whether the sewage from such localities in the neighbourhood as are subjected to a satisfactory system of drainage (supposing them to be split up into isolated Boards) be submitted to adequate chemical treatment before it is allowed to flow into the river, or be kept out of the river and employed for irrigation purposes, the obligations of the Joint Board's Act will be complied with. But as matters stand at present the Board have no choice. They once had twenty-six plans before them for carrying out the objects for which they were constituted. They chose one, and the land scheme which it involved was rejected by the House of Commons practically without a hearing. The Bishop of Manchester, if he knew all the circumstances of this case, would make a strong remonstrance against the influence of large landowners as opposed to Local Authorities. Whatever may be said as to the condition of the land purchased by the Board around Molesey, and its applicability to the purposes of a sewage farm, it must be admitted that the scheme promoted by the Board was defeated upon a perfectly different issue. The landowners never considered for one moment the purpose to which the soil was to be put. They started with a primary objection, that they would have no sewage farm "between the wind and their "nobility;" and hence this block. We cannot, however, regard all as lost. Among the twenty-five other schemes which were presented to the Board, we would call particular attention to one to which reference has often been made before in these columns, and that is Sir J. Bazalgette's plan for carrying the sewage of the Lower Thames Valley into the system of the West Kent Main Drainage Board, and emptying it at once, not exactly into the sea, but below the tidal basin of the Thames. In their difficulty, the Board are about to send a deputation to the Local Government Board, to solicit advice as to the measures they should adopt to carry out the obligations of their Act, the term of which expires next year. After then it may be the duty of the Local

Government Board to take the matter out of the hands of the Thames Valley Board, and carry out a system of drainage on their own account, at the expense, of course, of the ratepayers. The deputation which is about to proceed to Whitehall Gardens will find small comfort there. They will learn just what we have told them above—that the Central Authority will not take any action until the matter falls entirely into their own hands.

The Town Council of Liverpool decided, at a special meeting held on Monday, the 6th inst., to promote a Bill in the next session of Parliament, empowering them to obtain a supply of water from the River Vyrnwy and its tributaries. The ratepayers of Liverpool, however, are not favourable to that scheme; for, at a town's meeting held under the Borough Funds Act, they rejected by a large majority the proposal of the Town Council, but upon what grounds, after perusing the report of the discussion, we are by no means clear. So far as we can see, the expense of the scheme was not objected to, and but slight allusion was made to the rival scheme for obtaining a supply from Haweswater, and none whatever as to sharing with Manchester the yield from Thirlmere. The Bootle Well naturally attracted some attention, and Alderman Bennett was received with something like an ovation when he appeared on the platform and spoke in its support. But, after all, it seems to be substantially admitted that, as was stated last week, the well scheme is really a failure. Water of a certain quality is, no doubt, to be found, but it is not of such a quality as will satisfy the requirements of the inhabitants of Liverpool. It is reputedly contaminated with sea water from the Mersey, and, as such, cannot be received with satisfaction by the consumers of water. One speaker advocated an increased supply from Rivington, but did not make it clear where this was to come from. We thought it was well understood that the Rivington works were used up to their utmost capacity, and that any further draught from them could not be relied upon. They failed, in fact, when a strain was placed upon them a few years ago, and Liverpool was put on a short allowance of water. We regret very much that the Vyrnwy scheme was not approved of by the ratepayers at the town's meeting. A poll has been demanded, the result of which cannot be doubtful, but its cost will be great.

The Commission appointed to inquire into the cause of the high mortality in Dublin continue their sittings without very much practical result. The inquiry, however, is being gradually narrowed. The question as to the cause of the high death-rate seems now to be whether the tenement buildings, which we are bound to say disgrace the city, and, what is more, are very discreditable to some of the inhabitants, or the maliferous influences of the Liffey, are the more concerned in the fatal result. We put the Vartry water entirely out of the question, although it is a well-established sanitary fact that a sudden change from a hard to a soft drinking water, or *vice versâ*, is prejudicial to health. As regards the Liffey, we may say that there is no proof whatever, at the present moment, that the stenches which emanate from it are at all detrimental. It is true that the houses which line the river sides are of a high-class character, and the inhabitants are perfectly well able to take care of their sanitary condition. Independently of this, the foul emanations from the Liffey are not to be considered as "typho-"genic." The river, it is true, stinks—that is to say, at times; but the inhabitants do not in the least regard the smell with disfavour. One thing is certain, that a sewage scheme for Dublin must be devised. Where the sewage will be taken to it is not for us to say, but out of the city it must be carried.

A great outcry is now being made at Sheffield about a possible source of contamination to one of the Water Company's reservoirs. Building is going on, and the drainage arrangements appear to be somewhat imperfect. Sewage escapes from the drain-pipes, and no doubt percolates through the soil—it may be to the reservoir, it may be elsewhere, according to the levels. In any case, no harm can be anticipated to the inhabitants of Sheffield who use the Company's water.

At the meeting of the Metropolitan Board of Works last Friday, a letter was read from Mr. Robert Jones, Senior Engineer of the Commercial Gas Company, resigning his seat at the Board as representative of the Mile End Old Town Vestry.

The Gaslight and Coke (Chartered) Company have given notice to the Corporation of London, the Metropolitan Board of Works, and the Stock Exchange Committee, in accordance with their Act of 1876, that it is their intention to sell by tender £100,000 of new ordinary "A" consolidated stock of the Company, to be paid up in full on or before the 1st of December, and that the 7th of November has been fixed as the last day for receiving tenders.

RIVER CONSERVANCY AND WATER SUPPLY.

We return to this subject partly to correct an error into which we inadvertently fell with reference to the Thames Conservancy Act of 1878, and partly to point out the necessity of a General Act ensuring that, although streams used for water supply in every part of the country should be protected, taking care that there is no unnecessary interference with national industries, the constitution of Conservancy Boards should be such that the intentions of Parliament are carried out with intelligence and judgment.

And first with regard to the Metropolis and the Thames, we omitted to state that, by the Act of 1878, the jurisdiction of the Thames Conservancy Board was extended to apply to the tributaries, so far as purification is concerned, and that these powers have been already exercised, numbers of samples having been analyzed, and notices served in consequence. As, however, a period of twelve months is allowed for persons under notice to execute the necessary measures for purifying and diverting the sewage or waste, or other obnoxious matter, it is evident the full results cannot yet be seen.*

It is exceedingly desirable that the whole subject of River Conservancy should be considered with reference to legislation. The Bill brought in last session by the Duke of Richmond, but not carried, was perhaps only intended as a feeler, and in so far did good as opening the way to a full discussion of the subject. It was only permissive, and the Conservators were to have been elected and appointed with little reference to other than local interests. Wealthy and influential riparian owners certainly have a right to be heard in the event of repressive measures being taken on their river, but if they are the owners of works or manufactures they will look very leniently on offenders who do not happen to annoy them or injure their trade. They will think much of the convenience of utilizing the water and the water-way at their doors, and very little of the poor dwellers in cottages a few miles down the river. The parties really injured by the neglect of a river are very rarely those who would have power to act, or even feel authorized to complain. Those who could best determine the nature of the injury and the amount of it, and perhaps suggest a remedy if any existed, are not those likely to be appointed Conservators. It is to be feared that though fit and competent persons might present themselves for election on the first occasion, the supply would not be kept up. One independent member of a Board, anxious to promote improvements, would be checked by interested opposition; another, tired of suggesting and supporting proper measures distasteful to the majority, would throw up his thankless office with disgust; so that after a few elections the busybodies of the neighbourhood would thrust themselves forward and be elected, and those best qualified to act would be excluded.

There are several very distinct objects of river conservation, all important, though in a different degree, and not only varying for different rivers, but for different parts of the same river. Thus navigation is one of the main uses of some of our large streams, and would deserve and secure great attention from Conservators interested in the transport of goods. A river may, however, have its banks and bottom attended to, its locks may be in perfect order, and all shoals may be got rid of, the river at the same time being so polluted by certain manufacturing waste, allowed to enter some tributary, that for a long distance fishes are poisoned and the water rendered unfit for supply. It is evident that unless the Conservators are not only authorized, but enjoined to attend to sanitation as well as navigation, the former is very likely to be neglected. The proper conservation of a river should extend in some cases to the construction of embankments; in others, to contrivances for keeping back part of heavy floods, and diminishing the effect of floods on the lowlands near the mouth of a river; in others, again, it should include a supervision over fisheries. It is always and inevitably mixed up with health questions, and cannot be undertaken without some professional advice and assistance. Thus every Conservancy Board requires a Sanitary Officer as well as an Engineer, and these officers should be consulted whenever questions arise affecting sanitary or engineering questions. But chiefly is it important that in any general measure of River Conservancy the tributaries should be regarded as an essential part of the river, and be subject to the same investigation as the main stream itself. It is clear that the pollution even of the smaller streamlets that feed the tributaries risks, at any rate, the pollution of the stream. A jealous watch requires to be kept over the

* Our attention has been drawn to this by a note from Admiral Sir Frederic Nicolson, whose position as Deputy-Chairman of the Board has enabled him to carry out the necessary investigations, and initiate the measures that will no doubt soon produce a very satisfactory result.

whole drainage area of any river used for supply, if we would keep out of circulation all that is dangerous to health.

We must not shut our eyes to the consequences of such supervision, and the possible result of granting general powers to Conservancy Boards, which, if exercised in all cases in the same manner, might produce very serious results on important manufactures that have long been carried on in many parts of England. If, for example, we take the case of the River Mersey, we shall find some of its tributaries—the Irwell especially—so completely loaded with manufacturers waste as to be altogether unfit not only for drinking, but for any domestic use. Several streams reported on by the Rivers Pollution Commissioners are thus characterized. No doubt much may be done to improve them without interfering with their special uses, and indeed a great deal has been done already; but if the manufactures are to continue, there are no known means of avoiding this fouling of the water that do not involve serious injury to trade. Either the manufacturer is ruined or he throws up his business, and the manufacture is carried on in other countries where water can be utilized without the fear of interruption. It would be foolish to shut our eyes to these results in a country like ours, which lives only by its manufacturing industry. It must be perfectly clear that if the tens of thousands earning a living by these industries were starved or driven away, in consequence of the enforced privation of the use of the water essential to them, the increased purity of the stream would soon cease to have any value.

There are in this matter two sides to the question. The rivers, whether feeders or main streams, are only valuable in their relation to man, and it is a matter for consideration what is the best use that can be made of them. Manchester and Manchester industries would hardly exist in their prosperity without the water of the Irwell and its tributaries; but the waters of the Irwell are thus rendered unfit for household purposes. Water, however, for the City of Manchester and the many towns on the course of the river, can be obtained elsewhere, while it is only in this district that the combination of coal with water, in a convenient position for labour and conveyance to a market, are such as to have originated there a centre of important industry. So long, then, as an ample supply of pure water can be obtained elsewhere for the dwellers in the towns, the rivers flowing past them, if not in such a state as to injure the health of the towns, must be left to the manufacturers, and no River Conservancy can be admitted which will prevent the important works of such district from being carried on. Reasonable consideration of the whole condition of a neighbourhood is required before a decision can be fitly arrived at with reference to the sanitation of its rivers, so far as the total exclusion of manufacturers waste is concerned; but this does not affect the question of sewage, which cannot with safety be sent down any stream from a town on its bank. Here, then, the work of Conservators is needed, and cannot be done without. The nature of the pollution must be judged of, and the means of securing good sanitary conditions insisted upon.

It is to be hoped that, in the preparation of a Conservancy Bill, due attention will be paid to all these requirements. Authority is required to insist upon sanitary conditions, but judgment is needed that our great national industries should not be driven away.

Embezzlement by a Gas-Rate Collector.—At the Leeds Police Court last Friday, one of the collectors in the employ of the Leeds Corporation Gas Department—John Kaye—pleaded guilty to, and was sentenced to six months imprisonment for embezzling various sums, the property of the Corporation. He had been in the service of the Corporation for nine years, previous to which he was employed by the Gas Company whose works the Corporation purchased, and had always borne a high character. A short time back several small deficits were noticed in his accounts, and the suspicions of Mr. J. Lupton, the Manager of the Gas Department, were aroused. On an investigation being made, the prisoner admitted having entered in the cash-book smaller sums than he had received, and so had defrauded the Corporation to the extent of about £100.

Fatal Accident at the Golborne Gas-Works.—Last Friday an inquest was held on the body of a man named James Ashcroft, who was found dead at the Golborne Gas-Works on the previous Wednesday. Mr. John Fearns, the Manager of the works, said the deceased was yard foreman. On arriving at the works on Wednesday morning witness noticed a strong smell of gas, and heard a slight "uzzing" sound. On looking round he saw deceased near the purifiers, and showing no signs of life. The sound he heard was coming from the plug-hole at the bottom of the scrubber. He did all he could to rouse the deceased, but, failing, went for a medical man, who pronounced Ashcroft dead. The plug had been withdrawn from the scrubber to allow of it being cleaned, but this should not have been done without first bye-passing the scrubber, and sending the gas on direct to the purifiers. He had cautioned the deceased on the previous day to have this done. He estimated that about 10,000 cubic feet of gas had escaped. William Brown, night man, gave evidence as to the state in which he left the works on Wednesday morning, and the jury returned a verdict of "Accidental death."

THE THAMES SEWAGE OUTFALLS.

The dispute between the Conservators of the Thames and the Metropolitan Board of Works, as to the effect of the main drainage outfalls upon the navigation of the river, is about to receive the consideration of a legally-appointed tribunal. The Conservators, accepting as correct the statements contained in a report by Captain Calver as to the existence of shoals of sewage mud in the Thames, called upon the Metropolitan Board some time ago to dredge these shoals, as being obstructive to the navigation. The Board had previously denied that such shoals existed, and on being thus required to remove them, asked to be informed which were the particular mud-banks they were called upon to deal with. The Conservators appear to have looked upon this communication as a species of sarcasm, and forthwith proceeded to avail themselves of the arbitration clause in the Thames Navigation Act of 1870. Accordingly, they gave notice to the Metropolitan Board that they had appointed Captain Douglas Galton as their Arbitrator under the Act, and they requested the Board to appoint an Arbitrator on their side. This demand was, of course, complied with, the Metropolitan Board making choice of Mr. Bramwell. If the matter stopped here, it is inevitable that the two Arbitrators would never agree, each being practically an advocate for the Authority from whom he received his appointment. In fact, the term "arbitrator" is scarcely applicable, both these gentlemen having already declared their views, one being identified with the Conservators and the other with the Metropolitan Board. Two opposing counsel might as well be termed "arbitrators" between plaintiff and defendant, as for Captain Galton and Mr. Bramwell to receive such a designation in reference to the outfall dispute. The law, however, provides a third party, in the form of a referee or umpire, to be appointed by the Board of Trade. Supposing the choice to be wisely made, this gentleman becomes the real arbitrator of the case, to whom the presence of Captain Galton and Mr. Bramwell must be rather a source of embarrassment than otherwise. The individual appointed to this supreme post is, we understand, Sir Charles Hartley, a gentleman whose engineering experience is of a nature likely to qualify him for the exercise of an independent and unbiassed judgment as to the condition of the Thames in respect to the formation of mud-banks and shoals. There will be a strong array of counsel, the Metropolitan Board having retained Mr. Bidder, Q.C., Mr. Michael, Q.C., and Mr. Edward Clarke. The meetings will probably take place at the Surveyors Institute in Great George Street, and the dates set down for the proceedings are Nov. 4, 5, 6, 11, 12, and 13.

Although there is a tendency to look upon this inquiry as one of a sanitary nature, the Conservators must be understood as caring for the navigation of the Thames, rather than for its healthfulness. Captain Calver has doubtless introduced the sanitary element into his report, but the Conservators are primarily concerned with the sewage only so far as it creates in the river deposits which impede the navigation. In fact, we are not aware that the Conservators have anything to do with the sanitary issues of the Metropolitan main drainage. The presence of sewage has to be traced in order to prove that the mud-banks are the result of a discharge from the drainage outfalls, and only in this way does the question of sewage form part of the present inquiry. The proceedings now going forward have their foundation in the twentieth clause of the Thames Navigation Act of 1870, which specifies that "the Metropolitan Board shall, at "their own expense, keep the Thames free from such banks, "or other obstructions to the navigation thereof, as may "have arisen, or may arise, from the flow of sewage from "their outfalls for the time being into the river; and for the "purpose aforesaid the said Board shall have full power and "authority from time to time to dredge the said river, and "to remove such banks and obstructions; but all such "dredging operations shall be subject to the approval of the "Conservators, and, if they so require, be carried on under "their superintendence." This clause is obviously designed for the protection of the navigation, and nothing more. Le the river become ever so foul, the Conservators could have nothing to say to it, unless the foulness were so intense as to incapacitate the ships crews by reason of sickness. Even that could scarcely be called an "obstruction" to the navigation, and the only reasonable interpretation of the clause is, that it provides for the removal of mud-banks.

To fling rubbish into a river, and then to dredge it up again, seems contrary to common sense. If the stuff has to be removed, it would be cheaper to remove it at once, instead of first of all depositing it in the bed of the Thames. Thus

we find Captain Calver saying, in the first instance: "In "view of the injury I have now described, and the cause to "which it is owing, I hold it to be urgently necessary that the "Metropolitan Board of Works be called upon at once to "dredge away those portions of the accreted matter which "interfere with the convenience of navigation;" and then in the next place the same authority advises that the Board "be requested to adopt such other arrangements "as are calculated to prevent similar accumulations in the "future." Such a "request," however, though sensible enough if it be true that the outfalls create mud-banks, is outside the functions of the Conservators. If it be proved to the satisfaction of the Arbitrators—that is to say, to the satisfaction of the Umpire appointed by the Board of Trade—that the sewer outfalls are productive of obstructions to the navigation of the Thames, it will be for the Metropolitan Board to consider whether they will go on for an indefinite period to make and remove obstructive mud-banks. What "other arrangements" may be thought advisable, it is hard to determine. Possibly Captain Calver contemplates the extension of the outfall sewers, so that the discharge may take place lower down the stream. Other people, including Mr. Mechi, will contend for the utilization of the Metropolitan sewage, by applying it to the fertilization of the land. Others, again, will recommend precipitation by a chemical process; while perhaps another party will submit that the sewage should be simply strained, so as to abstract the grosser particles. It may, however, be hoped that the outfalls will be acquitted of the mischief ascribed to them. Possibly a qualified decision will be arrived at, laying upon the Metropolitan Board no heavier burden than they are able to bear. This is an age of compromises, and it will be a happy exploit if Sir Charles Hartley succeeds in establishing a modified verdict, in which the contending Arbitrators may merge their differences.

THE SOCIAL SCIENCE CONGRESS.

The Twenty-third Annual Congress of the National Association for the Promotion of Social Science was held in Manchester from the 1st to the 8th inst., and was, on the whole, fairly successful, although in some respects less brilliant than some of its predecessors.

Comprehensive as is the title of the Association, even to vagueness, its position and value, in the congeries of associations, societies, and institutes of all kinds with which the age is adorned, have been settled, within reasonably determinate bounds, by the principle of selection, and it is not the fault of the worthy associates if that position is not of the most brilliant in the eyes of the public. Important as the subjects, the study and elucidation of which form the *raison d'être* of the Association, may be to the life of the community, they are, in general, not of that quality which strongly appeals to public attention. The proceedings of the British Association for the Advancement of Science are in many departments most abstruse, but there are always striking lectures, accompanied by experiments, mixed up with their darker sittings; and not a few pleasant outings, disguised under the name of geological or other explorations, are provided to sustain the interest of the weaker brethren. These things are wonderfully efficacious in swelling the roll of devotees to science, but, from the nature of things, they are almost entirely absent from the *agenda* of a congress whose sections bear the names of Jurisprudence, Education, Health, Economy and Trade, and Art. It requires a considerable amount of devotion to abstract principles to attend for an entire week to the reading of papers and to more or less sober discussion on these subjects, especially when it is borne in mind that the bare recital of strings of facts, and the piling of statistics—Pelion upon Ossa of verbiage—will constitute the major portion of the proceedings. That there are any listeners at all, over and above those who take an active part in the business, is matter for congratulation, although, as the Press is always present, the speakers have the consolation of reflecting that, practically, the congress is being held wherever a newspaper penetrates, and that, by the medium of journals devoted to special subjects, those to whom their words are chiefly valuable will be able to receive and digest them at leisure. Hence the actual daily attendance in any section is not by any means a gauge of the notoriety which will ultimately attach to the day's proceedings; and it is fortunate that such is the case, for otherwise the work of the most practical divisions of the congress would suffer from the superior but evanescent attractions of discussions comparable to those proper to the debating class of a literary institute.

If it be granted that the Association is a useful body, and that the machinery of an annual congress is suitable for the ventilation of questions which affect the body politic, there is some danger that the precise value of the manner and matter of the various papers and discussions may be unappreciated by those who are best instructed in the subjects of which they treat. The flavour of amateurishness, which is rather conspicuous among the various characteristics of the work done, is apt to excite some scorn in the mind of a man who knows, or thinks he knows, to the bottom of a matter which has been brought forward in such a *dilettante* manner. Consequently, he fixes a depreciatory value on the associates generally, and by abstaining from all contact with them, leaves them still more to the mercy of the amateurs among them, and the result is that the gap between popular and professional ideas is widened instead of bridged. The practical sanitarian must not look to the proceedings of the Health Section for instruction, any more than the artist must look for inspiration to the Art Section. Neither must he draw odious comparisons between the Association with the sounding name, and the quiet transactions of his own professional institution. The true function of the Social Science Congress is to form public opinion by originating informal conversations on debateable points of our social economy; to keep well before the public mind the failures in our system of living; to impress upon each individual the relation which he bears to his neighbours, and the influence, moral and physical, which he unconsciously exerts upon society at large; to diminish that unconsciousness as much as possible, so that the evils of associated existence which must still remain shall be due neither to ignorance nor to apathy; and to prepare the way for, and to sustain the action of beneficent legislation, whether for the protection of health, wealth, or morality, by the creation of a sound body of popular opinion, without which the best laws that were ever made must remain in the dead letter.

These, especially the last, are the true objects which the Social Science Congress can attain, and in the pursuit of which it has no rival. The chief evils which appear to threaten its existence are dilettanteism, public indolence, and the absence of authoritative support. Of these the first named is perhaps the deadliest in its effects upon any association which aims at the union of scientific and popular objects.

With most of the proceedings of the Congress we have here very little to do, and we shall only touch upon such of the transactions as lie within our scope. The Health Section is, therefore, the only one which presents features of particular interest for us. This section, among other peculiarities, possessed a greater air of practical common sense than any of the others, and also escaped, until the very last day, the infliction of female oratory which rang through the neighbouring rooms. How much of cause and effect was contained in these co-existent features must be left to conjecture.

The work of the section commenced on the second day of the meeting, with a paper on the growth of suburban districts with conflicting systems of sanitary control, which so complicate the problem of the prevention of zymotic disease. The difficulty of enforcing sanitary regulations in populous districts which have grown up, under rural organizations, in the immediate neighbourhood of our large towns, was well brought out by Mr. Haviland, of Northampton, in his paper. He referred to the liberty enjoyed by speculative builders, in such localities, of erecting houses on any site, however insalubrious, and the comparative indifference of householders, when living "in the country," to the all-important principles of sanitary science. The writer advocated more power being given to rural authorities, so as to assimilate them to urban authorities. Dr. Hardwicke, Coroner for Middlesex, and Mr. Baldwin Latham, C.E., concurred in the view that a residence in the country was not necessarily more healthy than in a well-regulated town, and Captain Galton quoted statistics to show that the death-rate of Eltham, with a population of one per acre, was about equal to that of certain model lodging-houses, where the population was 1140 per acre. Captain Galton did not go on to say that residence in one place was as eligible as in the other. Unfortunately, people still prefer living in sparsely-populated country places, if they can possibly manage to do so, and the consequence is that there is neither the public revenue available for the payment of skilful health officers, nor is there the same facility for inspection in the one case as in the other; and, as Mr. Fuller, Chairman of the Withington Local Board, intimated, rural districts are generally controlled by strangely-constituted authorities, employing whatever officials they can obtain with the remuneration they are enabled to offer, and it is not by any means clear that extension of the powers of such bodies would be an altogether unmixed blessing. The Chairman, Mr. F. S. Powell, in summing up, contrasted the reluctance manifested by suburban districts to being incorporated with urban districts in England, with the eagerness said to be shown under similar conditions in America. He said that a case in point had happened in the suburbs of Boston, Mass., with the result of doubling the value of property in the extra-rural districts. But it was not altogether clear, from his remarks, whether it was not merely the rateable value that had been raised, for we know that the reluctance mentioned has less reference to want of appreciation of the benefits to be gained than to a lively objection to pay the increased rates which incorporation generally brings with it. We know that drainage, paving, lighting, and sanitary inspection are good things in their way, but are apt to swell the rates in unpleasant proportion to the rent of a house, even where houses stand thickly, and where there are plenty of shoulders to bear the burden; but the like blessings in a thinly-inhabited district are simply impossible. Mr. Powell was conspicuously right in denouncing the system of granting Private Acts to towns, by which they received powers not only differing in the actual letter, but, in the further power which they conferred of making bye-laws, confusion was "worse confounded." He advocated the adoption of a uniform system of building regulations throughout the kingdom. This would doubtless be a good thing if such regulations were properly drawn up, and care everywhere taken to have them enforced. Finally, on the motion of Mr. Haviland, seconded by Professor Gairdner, of Glasgow, a resolution was passed, recommending the Council to memorialize the Government to obtain powers to bring municipal areas and suburban districts under a single sanitary authority.

Mr. Baldwin Latham, C.E., followed with a paper on the influence of sewage farms on public health, in which he maintained the innoxious character of these establishments. He showed, from the example of Croydon, that even when typhoid fever was epidemic

in the neighbourhood, the farms themselves and their immediate surroundings remained exempt from contagion, and that the infectious character of the sewage from places so affected was destroyed by its exposure and treatment in the process of irrigation. He lamented the prejudice that exists in many places against sewage farms, on the ground of their supposed ill effects upon the health of the adjacent districts. The irrepressible "storm-water question" made its appearance in the course of the discussion which followed the reading of the paper, as was natural in any consideration of the subject of sewage utilization. Alderman Thompson stated that the Manchester Corporation would shortly be compelled to expend a large sum of money in drainage works, but they did not see their way to the adoption of irrigation, owing to the cost of the necessary land.

A paper on Air Pollution, by Mr. C. Estcourt, City Analyst to the Corporation of Manchester, concluded the first day's business. Mr. Estcourt had the great advantage of treating a subject which is never far removed from the thoughts of visitors to Manchester. Hence his remarks were as apposite as those of a popular orator when he "improves the occasion" of a striking public incident. Walls, ironwork, struggling vegetation, all testify, in any of our great manufacturing towns, to the reality of what Mr. Estcourt essayed to describe. He stated that 150,000 tons of vitriol were annually showered over Manchester from the coal that was consumed there. We are so familiar now with these striking images, that this and similar announcements, which at one time would have harrowed the public soul, were received with equanimity, and even with smiles. The Bishop of Manchester on another occasion brought the magnificent total into something very like the *reductio ad absurdum* by announcing his discovery that his own proportion of that dulcet fluid would be about 2 lbs. per day, if it all had to be consumed on the premises, and therefore he hoped some arrangement was in operation by which its bulk was otherwise dissipated. Mr. Estcourt stated that, to a certain extent, the existence of blacks, or unconsumed soot, was an evidence of less sulphur contamination in the air than when, by more perfect combustion, the whole of the gases arising from coal were set free. He also dealt with the graver mischief of chemical and mineral fumes, instancing their destructiveness, and also the exceeding difficulty of all attempts to suppress them. Much has been done of late years in this direction, but a great deal yet remains of noxious pollution in the air of manufacturing districts, the greater proportion, if not all of which is clearly preventible; and the duty of keeping a clear atmosphere for the poor to breathe, and through which the sun may shine with cheering and healthy radiance, is as incumbent on the govering bodies of crowded towns as is that of providing pure water and wholesome dwellings.

Mr. J. Corbett, of Manchester, on the third day opened a question of much importance, in his paper on the sanitary condition of the existing houses of the middle classes, and the best means of building so as to combine sanitary and commercial value. From the interest which was taken in this paper, and the prolonged discussion that followed, it was very evident the subject came home to most of those present. The absence of stringent regulations as to the position and fittings of water-closets, drains, sinks, and ventilators, was generally deplored; for it was acknowledged that in existing occupied houses the tenant was completely in the hands of his landlord, whose sanitary senses were generally singularly hard to awaken when the expenditure of £25 or £30 was in question. Professor Gairdner went to the root of the matter when he said that while the management of such things was left, as at present, entirely in the hands of architects, builders, and plumbers, the individual tenant was helpless. He deprecated too much reliance upon public authorities for redress in cases of defective house sanitation, and praised the system of voluntary associations for the inspection of such matters. This recommendation does not appear particularly happy, when read after his first remarks. As matters now stand, a tenant may be of opinion that the water-closet of his house is a mere appliance for filling his rooms with poisonous gases, and may have his opinion confirmed by any sanitary engineer, or any medical man on the staff of an inspecting association. What then? It will cost perhaps £30 to put matters straight, and he perhaps has not that amount of money to spare, or is wisely unwilling to lay it out in benefiting another man's property; yet his landlord refuses to effect the desired improvement. The tenant cannot invoke an authority which will compel the landlord to do what is necessary, and so must either stay and be poisoned, or leave the house, only to shift the threatened infliction on to his successor. That is the weak point in the otherwise admirable scheme of an association for household sanitation—there is no power to compel obedience to its demands. Mr. M. H. Judge doubted whether our sanitary knowledge is sufficiently advanced to justify legislation in this direction. But, surely, we know enough of the simple canons of sanitation to tell the difference between a house properly drained, trapped, secured against the direct admission of sewer gas, supplied with water, and ventilated, and one in which all such considerations are flagrantly disregarded; and we know that, other things being equal, there is less liability of its becoming a centre of disease in one case than in the other. From this standpoint the direction and scope of a few general building regulations for universal adoption do not appear to present insuperable difficulty, either in conception or carrying into force. The result of the discussion was a resolution, proposed by Mr. Fox, of Lymm, seconded by Mr. Haviland, and carried unanimously, to the effect that future building laws should be enacted of equal obligation upon town and country. From the general tenor of the discussion, it might have been expected that there would have been included in the resolution some reference to existing unsanitary dwellings, but there was none expressed.

(*To be continued.*)

Communicated Article.

ON THE EFFECTS OF THE CONTACT OF TAR WITH COAL GAS.

By Mr. R. H. Patterson, F.S.S., late Metropolitan Gas Referee.

The hydrocarbon substances condensed out of coal gas in the process of purification are known to exert a considerable influence upon the gas with which they are in contact; but it is not yet known accurately what those effects are, and, still less, in what way this contact of tar with the gas operates. According to what is at present known on the subject by the few persons who have investigated or considered it, this contact produces various and, as regards illuminating power, entirely opposite effects upon the gas; and it is obvious that these opposite effects must be produced by some great difference in the conditions under which the contact takes place.

The importance of the question is manifest from the fact that the chief effects (whatever they be) produced by the contact between the gas and the condensed hydrocarbons (roundly speaking, the tar) take place upon the illuminating power, the light-giving qualities of the gas—the very thing for which coal gas is manufactured, and which constitutes its commercial value. Further, this contact is not a trifling one; it takes place on a very large scale. It is needless to say how large is the quantity of tar condensed out of coal gas, but it is well to bear in mind how extensive and prolonged is the contact which occurs between it and the gas in the process of manufacture, and, indeed, of distribution also. The hydraulic main, as ordinarily used, is really a tar-bath, in which the gas at its outset is thoroughly washed with the tar. The hydraulic main, or water-trough, has long been employed as the most convenient means of sealing the outlets of the retorts, so as to prevent any back-flow of the gas into the retorts during the drawing and charging. But the water with which the hydraulic main is originally filled is quickly converted into, or, rather, is replaced by liquid tar; and the gas is thoroughly washed by this tarry liquor as it bubbles up through it from the mouth of the dip-pipes. Thereafter, although the main body of the condensed hydrocarbons is drawn off into the tar-well, a considerable portion of tarry deposit accompanies the gas all through the condensers. Nor does the contact between the gas and tar end even here. It is continued in the scrubbers—especially in the coke scrubbers, which are still the ones most frequently employed—the coke or other scrubbing materials becoming thickly coated with tar. And finally, to some extent, the contact of the gas with its condensed deposits occurs in the syphons and other parts of the distributing pipes.

It is only within recent years that any knowledge has existed relative to the effects of tar upon the illuminating power of gas. From the outset of gas-making, it was found that in the process of distilling the coals a large portion of hydrocarbon substance was volatilized in the retorts, which yet could not be retained in the gas. Accordingly, this substance, or as much of it as possible, was drawn off at once into the tar-well, and there was an end of it. Whether it produced any effect upon the gas during the period of contact, no one thought of inquiring.

During the latter years of the Sulphur Question, which so long taxed the ingenuity and baffled the efforts both of chemists and gas engineers, and when so many substances and processes were tried for the extraction of the bisulphide of carbon, tar was tried. It had been tried first by Mr. Harris, at Bow Common, in 1865; but in that case it failed even to do any good in reducing the sulphur in the gas. How this trial was conducted has not been stated; there was no mention either of the temperature of the tar, or of the mechanical arrangements by which the tar was brought in contact with the gas. Mr. Harris's record of these experiments was briefly stated thus:—"July, 1865. Washed gas with tar. Not any good." In 1868, when the sulphur maximum was being keenly contested in Parliament (and settled at last by a "leap in the dark") the Chartered Company acquiesced in the Bill, believing that they were able to extract the "sulphur compounds" by means of tar; but, when Mr. Keates was called in to make experiments on the subject, it was found that the plan was impracticable—that is, of course, according to the form in which the attempt was then made. The result of these experiments, as afterwards stated by Mr. Evans to myself and our fellow-Referee, was tolerably or satisfactorily successful as regards extracting the "sulphur," but that the process was quite useless practically, because he found that the tar simultaneously absorbed from the gas a large portion of its hydrocarbons, thereby destroying the illuminating power. To use his own phrase, the tar "took the guts out of the gas." Thus Mr. Evans's experiment gave very different results from the similar experiments previously tried by Mr. Harris at Bow Common. Mr. Harris had found that the tar did *not* remove the sulphur, and also (it may safely be inferred) that it did not destroy the illuminating power; for, if the latter result had occurred, it is hardly possible to conceive that he would not have observed and mentioned it, as he did in connection with other experiments where this injurious effect was observed. Also the experiments of the Chartered Company were privately made, so that, as regards general knowledge, it may safely be said that down to that time nothing reliable was known, or had been practically ascertained in gas-works, as to the effects produced or produceable by the contact of tar with the gas.

Soon afterwards—in 1872–73—processes for "carburetting" gas obtained great prominence, and excited general attention. Numerous patents were taken out for air gas and for water gas, for carburetting air or carbonic oxide, and also for carburetting and enriching coal gas itself. One part of Dr. Eveleigh's patent, also, consisted in distilling the tar obtained from coal carbonized at a low temperature

(and therefore richer than ordinary tar), and adding to the gas the vapour obtained from this rich tar. In this way the idea gained ground among gas engineers that tar might be utilized so as to increase the illuminating power of the gas without any of the special patented processes of "carburetting," and *in the ordinary processes of gas-making*, or rather of purification. Since hydrocarbons could be employed to enrich gas by a separate process, could not something of the same kind be done by means of the tar in the purifying processes or apparatus? Accordingly it became the fashion, at Gas Managers Associations, to extol the advantages of prolonging the contact between the gas and tar. As many readers will remember, it became a maxim that a long length of pipes should be employed between the hydraulic main and the condensers, in which pipes the gas and tar might flow side by side. Such an apparatus or arrangement, I may observe, had been in use for many years before then, at the Haggerston works of the Imperial Company; but this arrangement of the pipes (they are placed along the walls of the retort-house) had been adopted merely to economize space. The able Engineers of those works had never claimed any benefit from it in regard to the illuminating power; nor did they do so when the arrangement which had been so long in use at their works suddenly rose into vogue as something novel and important. Further, at that time (about 1874) Graham's horizontal condenser was constructed, and came under the notice of the gas world. Whether this form of condenser was constructed for the sake of meeting the prevalent maxim in favour of prolonging the contact between the gas and tar I cannot say; but, at all events, this condenser immediately rose into notice on the ground that it did answer this purpose. I confess I do not see in what way the Horizontal condensers bring the tar more in contact with the gas than the Vertical condensers do. In the former, the tar flows chiefly in a mass along the bottom of the pipes; while in the latter it covers and trickles down the sides of the upright pipes into the tar-trough at the bottom of the apparatus. Be this as it may, Graham's condenser rose into favourable notice in connection with the new idea of increasing the illuminating power by prolonging the contact between the gas and the tar deposited from it. No testings, however, were made to determine whether this was the case or not. Certainly no experiments of this kind have been published; and although the advertisements of this kind of condenser have claimed a valuable gain in illuminating power, no facts have been adduced in support of this claim. I repeat, I cannot see how the horizontal condenser differs materially from the common vertical ones as regards the contact between the gas and tar; and I think it is manifest that *if* any gain in illuminating power were thus obtained, it must equally have been obtained from the length of main along the walls of the retort-house, long before in use at the Haggerston works, and more or less in other gas-works.

Upon grounds therein stated, in the second edition of my treatise on "Gas Purification in London," published in 1874, I ventured to suggest that the practice or doctrine then in vogue, as to prolonging the contact between the gas and tar, might possibly be found to have a different effect from what was currently believed; and, indeed, that there might be a loss instead of gain in the illuminating power of the gas. I had often observed the absorption of the hydrocarbons, when gas is passed through india-rubber tubing, to such an extent that the texture of the tubing became destroyed. And here, parenthetically, I may venture a suggestion as to the chemical or physical principle upon which the attraction between the tar and the hydrocarbons in the gas proceeds. The most generally useful, and, indeed, fundamental branch of Chemistry is that which sets forth the affinity or power of attraction which the various substances in nature have for one another; and also, in the case of substances which mutually attract or tend to combine with one another, the *comparative* power of affinity which each of these substances possesses for the others. No list of this kind, nor any systematic teaching of this knowledge is to be found in chemical text-books; nevertheless, if such a list be run over in the "mind's eye," it will be seen—as is well known—that the commonest kind of chemical affinity is the attraction of Opposites, as between acids and alkalies. But there is also a law of affinity of an entirely different, nay, wholly contrary character—viz., the attraction of Similars, a parallel in the chemical world to the old saying in the moral world, or human life, that "like draws to like." And, perhaps, as chemical science approaches perfection, and when the molecular structure as well as atomic composition of substances has been ascertained, it will be found that nearly the whole phenomena of chemical affinity can be classed under the one or the other of these laws; the molecules of chemical Opposites *fitting in*, and of Similars *fitting on* to one another. For example, is it not, even now, conceivable that the remarkable affinity which NH_3 (ammonia gas) has for H_2O (water) may be really due to the preponderance which hydrogen has in each of those substances, and to a corresponding molecular structure, or arrangement of the component atoms; while, further, the substance combined with the hydrogen is, in both cases, one of the permanent and simple gases which constitute the atmosphere? Anyhow, that there is an affinity of Similars is beyond dispute, and in my pamphlet I showed that it plays a very important *rôle* in the purification of coal gas. At that time, however, the action of the tar was very much in the dark; and, however confidently some opinions might be expressed, there was really little else but conjecture to go upon. So far as anything was then *known*, it was that under *some* circumstances (not correctly determined) this contact between the gas and tar was detrimental to the illuminating power, which, of course, implied that the hydrocarbon tar attracted and extracted a portion of the hydrocarbons contained in the gas. And if the tar attracted hydrocarbons at all, it was almost certain, *à priori*, that it would extract the richer hydrocarbons first and chiefly.

So the question stood in 1874. Two years afterwards, however—in 1876—certain and discriminating knowledge as to the action of tar upon illuminating gas, was conveyed to the gas profession in a paper read before the North British Association of Gas Managers, by Mr. Young, of Clippens; who, since then, along with Mr. Aitken, has turned that knowledge to practical account in a process for securing and utilizing the illuminating gas which, but for such processes, escapes and is lost during the manufacture of paraffin oil from shale. This process, still in its infancy as regards application, is one which seems to have a great future before it, and in principle, at least, and partly directly, will ere long play an important part in the manufacture of illuminating gas; yet it arose from what may be called a merely accidental observation. Indeed, it is a curious fact and feature in the history of inventions that so many valuable inventions have arisen from the mere incidental observation of some fact, and often in a line of work remote or distinct from that to which the invention or deduction from the fact is thereupon applied. It is an old saying of a Latin author, when speaking of the aspects of Nature, "How many things do painters see which we do not see!" And this is equally true of inventors; who, gifted with the swift perception of analogies, and with the power of intellectual inference or deduction, discern important sequences from an observation which may have been made by hundreds or thousands of others—nay, which may have lain before the eyes of mankind as an "open secret" from the beginning of time. Mr. Young's inventions, it is needless to say, do not belong to the class of memorable discoveries, and, as will appear in the sequel, they did not possess the novelty at first assigned to them; but, upon various grounds, it is worth recording the incident which gave birth to them.

Mr. Young's brother-in-law, Mr. Cusiter, gas manager at Dalkeith, had been experimenting with a view to obtain a perfect gas-meter by employing liquids not liable, as water is, to variation of volume from evaporation. Mr. Cusiter had tried glycerine, but on the whole was not satisfied with it; and Mr. Young suggested the use of "intermediate paraffin oil"—a comparatively heavy hydrocarbon liquid. But, when the meter was filled with this oil, upon lighting the gas which had passed through the meter, the flame burnt blue—nearly all its illuminating power was gone. Many persons would simply have said, "This won't do; let us try something else." But Mr. Young saw more than this. Manifestly, the oil absorbed the illuminating elements (the richer hydrocarbons) from the gas; and he resolved to make use of this fact as a means to fix and get possession of the illuminating gases which were allowed to go to waste in his own business of manufacturing paraffin oil.

Mr. Young pursued his investigations, and has detailed the results in subsequent papers; and, confining myself to the subject in hand, I may shortly state the facts which he ascertained with reference to the action of coal tar upon coal gas. It had long before been well known that coal tar was a very composite substance, Indeed, it is a very remarkable fact that the tarry oil obtained from coal in gas-making contains the material of the valuable aniline dyes, while the residuals from petroleum do not contain them at all. Petroleum oil appears to have been formed from buried hydrocarbon or vegetable substances at a very low temperature, and doubtless by a very slow process, chiefly of compression; whereas coal has evidently been formed under a high temperature, and coal gas is produced at the highest possible temperature conveniently attainable, and in the oil or tar deposited from it the hydrocarbons exist in dissimilar compounds from those in petroleum oil. All this had long been known; but Mr. Young deserves very great credit for ascertaining the effects produced by the various and separated ingredients of gas tar when brought in contact with coal gas. Previously, as already stated, the facts appeared to be that sometimes there was a gain in illuminating power when the gas and tar were brought in contact, and sometimes there was a loss. Mr. Young's experiments confirmed this inference from such facts as had been observed. He showed that, really and truly, there was a double and opposite action of the tar when brought in contact with the gas; but he also showed, to demonstration, to what this double action, with its opposite results, was owing.

By passing coal gas through the heavier kinds of liquid hydrocarbons, the illuminating power was almost wholly destroyed; by passing it through the lighter liquid hydrocarbons, the illuminating power of the gas was greatly increased. In other words, when presented separately or by themselves to the gas, the heavier portion of the tar absorbed hydrocarbons from the gas, while the lighter portion was absorbed into the gas. This was the primary fact arrived at by Mr. Young, and which thenceforth settled the main part of the question as to the action of the tar upon gas. His subsequent investigations, along with Mr. Aitken, for enriching gas by returning into it the naphtha, or lighter portion of the tar, previously deposited from the gas, will be considered when I come to that part of the subject, and with (as will appear) the aid of another and earlier discoverer than Mr. Young.

In this first article I have endeavoured to set forth the actual knowledge existing in the gas world as to the effects of the contact of coal tar with coal gas, taking this information from papers and discussions before the British and other Associations of Gas Managers; from correspondence in the pages of the JOURNAL; and, subsidiarily, from conversations which I have had on the subject with some of the leading gas engineers.

In the next article I shall have to open a new branch of the discussion, and show the very startling fact that all the knowledge now passed in review—which is really contained in Mr. Young's papers, and which he so ably and thoughtfully discovered for himself—had not only been long before *known* (for much knowledge may exist in some quarter or other without being practically useful or generally

available), but had been clearly set forth in a form addressed to the gas profession, and with which the gas managers might well have been acquainted.

Legal Intelligence.

SOUTH SHIELDS COUNTY COURT.—THURSDAY, OCT. 9.
(*Before Mr.* E. J. MEYNELL, *Judge.*)

SOUTH SHIELDS CORPORATION *v.* SOUTH SHIELDS GAS COMPANY.

In the JOURNAL for Aug. 26 was the report of the evidence given in this case, which was brought to recover the sum of £20 15s. 11d. for the use of a steam-roller, and for repairing one of the roads in the Corporation district after it had been opened by the Gas Company for purposes of main-laying. The Judge reserved his decision, so as to be able to read through the sections of the Act of Parliament bearing on the matter in dispute.

The TOWN CLERK (Mr. J. M. Moore) appeared for the Corporation, and Mr. J. STRACHAN for the Company.

Mr. MEYNELL now read his judgment. He said: This action was brought to recover the cost of repairing a portion of Ocean Road in South Shields, and it was brought under the provisions of the Gas-Works Clauses Act, 10 Vict., c. 15. By the 10th section, when the undertakers (the Gas Company) open or break up the road of any street, &c., they are with all convenient speed to complete the work, fill in the ground, and reinstate and make good the road, and they are to keep it in good repair for three months after replacing and making good the same, and for such further time, if any, not being more than twelve months, as the soil broken up shall continue to subside. The 11th section imposes a penalty on the undertakers in case of neglect or omission, and the 12th section enacts that if any such delay or omission, as aforesaid, takes place, the persons (in this case the plaintiffs) having the control or management of the street, &c., in respect of which such delay or omission shall take place, may cause the works so delayed or omitted to be executed, and the expense of executing the same shall be repaid to such persons by the undertakers, and such expenses may be recovered in the same manner as damages are recoverable under this or the Special Act. By section 40, if the gas-works be in England, the clauses of the Railway Clauses Consolidation Act, 1845, with respect to the recovery of damages not specially provided for, and of penalties, and to the termination of any other matter referred to justices, shall be incorporated with this and the Special Act. The clause in the Special Act was referred to at the hearing, declaring how damages are to be recovered, and I presume there is none; but by the 140th section of the Railway Clauses Consolidation Act it is enacted that in all cases where any damages, costs, or expenses are by this or the Special Act, or any Act incorporated therewith, directed to be paid, and the method of ascertaining the amount, or enforcing the payment thereof, is not provided for, such amount, in case of dispute, shall be ascertained and determined by two justices. In this case the defendants had repaired the road in question after breaking it up, but the plaintiffs alleged that they had not done so properly and efficiently, and therefore the plaintiffs did the work, and brought the present action to recover expenses. A preliminary objection was taken that no action would lie, and that the plaintiffs only remedy was before justices. I was inclined to think that construction right, but I reserved the point and heard the evidence, and having now fully considered the objection, I think it is a good one. Where a right, or pecuniary obligation, is created by statute, and no remedy is given, an action will lie; but where the statute gives a remedy, as a general rule that remedy must be followed. The 10 Vict., c. 15, s. 12, says that those expenses may be recovered in the same manner as damages are recoverable under this or the Special Act. Section 40 incorporates the Railway Clauses Act with respect to the recovery of damages not specially provided for, and that Act says damages are to be recovered before two justices. The case of the *Mayor and Corporation of Blackburn v. Parkinson* (28 *Law Jour.*, M.C., 7), and the *Vestry of St. Pancras v. Battensbury* (26 *Law Journal*, C.P., 243), are in point. Mr. Moore argued that the word was "may" be recovered, and therefore the plaintiffs had an option; but in the Blackburn case, which seems exactly in point, the word was "may;" in the St. Pancras case it was "shall." The plaintiffs must be non-suited.

Miscellaneous News.

THE LIVERPOOL CORPORATION (VYRNWY) WATER SCHEME.

A Special Meeting of the Liverpool Town Council, convened under the Municipal Corporations (Borough Funds) Act, was held in the Town Hall on Monday, the 6th inst.—the MAYOR (Alderman Royden) in the chair—"to consider and, if thought expedient, to direct the promotion by the Council of the said borough in Parliament of a Bill for the purpose of empowering the Corporation to impound and obtain a supply of water from the River Vyrnwy and its tributaries, in Montgomeryshire, and for other purposes; and that the costs and expenses of and in relation to such promotion be defrayed out of the funds or rates in the hands of the Council, or hereafter to accrue to them, on 'The Liverpool Water Account.'"

Mr. WILSON (Chairman of the Water Committee), in moving a resolution authorizing the promotion of the Bill, said: The Water Committee have carried out the orders of the Council with respect to the new bore-hole at Bootle. Messrs. Mather and Platt have sunk the hole to a depth of 1300 feet, and have fixed the necessary machinery. The engines were started on the 25th of August, and the result has been that the Committee have been unable to test the engines at the guaranteed speed, as there is not sufficient water for the purpose. When the engines are driven at the greatest practicable speed, the bore-hole yields 2⅞ million gallons per week, of which ¾ million gallons are taken from the existing well. I may remark that the yield of the old well continued to decrease before the new engines were started. It is evident, therefore, that the local sources of supply cannot be relied upon to meet the rapidly increasing wants of Liverpool and its vicinity. I am indebted to Mr. Gale, the Engineer of the Glasgow Water-Works, for valuable information on two important points—first, as to the effect of storeage (in a large lake) of water discoloured by peat; and, secondly, as to the action of soft water on lead. I have here flood samples of the water flowing into Loch Katrine, the water taken on the same day from the loch itself, and the water distributed to Glasgow. These samples fully bear out what Mr. Bateman and Mr. Gale say, that although in heavy floods the streams run into the loch like coffee, yet such is the settling and bleaching power of the body of water, and the large area of the lake, that even in heavy floods the water delivered to Glasgow is but slightly tinged in colour, although it is neither decanted nor filtered. If the effect is so great with water like that of the streams flowing into Loch Katrine, I feel assured that the water from the Vyrnwy will be colourless when delivered to Liverpool, and, as far as colour goes, will certainly not require filtration. After comparing the gathering-ground of the Vyrnwy with those of some of the Scotch lochs, I am struck with the great advantages the Vyrnwy possesses for yielding a very fine quality of water. With reference to the action of soft water on lead, the question was raised when the Glasgow Corporation sought to promote the Bill for obtaining water from Loch Katrine in 1854. It was stated by Dr. Penny, a scientific witness against the Bill, that the water acted so strongly on lead that its use would be dangerous. The point was felt to be so important that the Parliamentary Committee adjourned, in order that the truth of the statement might be proved. Professors Graham and Thomson, Mr. Dugald Campbell, Dr. A. Swaine Taylor, and Professor Hofmann, all of London, and Professor Anderson, of Glasgow, were appointed to make the requisite experiments, and to give evidence upon the subject, and Mr. Bateman arranged a series of experimental works at the Trossachs, in order that those gentlemen might have the opportunity of testing the matter in the most complete way. In their reports they agreed that, although the water acted strongly on bright lead, yet it was innocuous and perfectly safe for domestic use under ordinary circumstances, and with the ordinary lead pipes and cisterns. This was so conclusive that when the Bill was introduced in the next session of Parliament, the opponents did not even raise the question. Passing to another branch of the subject, we have been told that we might effect a great economy by joining Manchester in a water scheme; but a little consideration will show that this cannot be the case. When we went to Manchester we were told, that the new reservoirs at Longdendale having been successfully completed, it would not be necessary to go on with the Thirlmere scheme for some years, and that Manchester would naturally postpone the works as long as possible. At the same time they were quite willing to meet Liverpool on fair and equitable terms, and, if it were made worth while, might commence their works at an earlier date than would be necessary for their own purposes. The meaning of that was—and I consider it a fair and even a liberal proposal—that Liverpool should take one-half of the water and divide the cost. Now, consider the effects of this, fair as the offer is. The estimated cost of the first 10 million gallons per day obtained from Thirlmere is £2,250,000, to which, as far as Liverpool is concerned, must be added the cost of a pipe line from Chorley. If Manchester sells Liverpool 5 million gallons, it will be at a cost of £1,125,000, to which add the Chorley pipe line, £350,000, and the cost to Liverpool will be £1,475,000. The estimate for 13 million gallons per day from North Wales is £1,250,000; so that we can actually obtain 13 million gallons from Wales for less than the 5 millions from Thirlmere. In addition to this, we have the command of a source of supply equal in extent to that of Manchester. We shall also be in a position to supply water, either from Rivington or the Vyrnwy, to towns along the lines of aqueduct that are at present greatly in need of pure water. Then it must be remembered that the ultimate supply from either the Vyrnwy or Thirlmere is limited. If Liverpool and Manchester continue to increase at the present rate, both sources will be exhausted in less than a century; and, considering that 35 years have elapsed since the Rivington scheme was commenced, it does not seem unreasonable that provision should be made for the longer period. I have been urged to make it clear that the new scheme will not increase the burden on the ratepayers in the borough, and on this point I have little doubt. We have a large surplus income arising from the sale of water which was wasted under the old system of management. This will amount to £60,000 per annum; that is to say, that when, from the natural growth of population and trade, our average weekly delivery amounts to 122½ million gallons per week, being the same as we delivered in 1871, our gross income will be about £60,000 more than in that year. It must be remembered our income increases at the rate of more than £5000 per annum, and eight years will probably elapse before the new scheme is completed. At present we are employing our surplus income in putting the works, both in Liverpool and at Rivington, in perfect order, and the balance is carried to a depreciation account to meet any liability from accident; but as that fund is rapidly accumulating, the surplus may be employed, when the time arrives, to pay the interest on the new works. The only remaining point to which I wish to draw your attention, is the threatened opposition from those connected with the Severn. After the experience of Manchester in promoting the Thirlmere scheme, it is evident that no one can foresee what opposition may arise. I know no scheme which seemed less likely to arouse local opposition, and yet which was more severely contested. After reading the reports of the various meetings called for the purpose of organizing an opposition to Liverpool, I find that the reasons given for such a course are—injury to fisheries, interference with the navigation by lessening the dry-weather flow, and the necessity for floods to carry down the sewage. I feel confident that we can show a Parliamentary Committee that we can improve the fisheries by the removal of weirs, and add to the dry-weather yield. We have the strongest evidence that the navigation will not be affected; and it will be for Parliament to say whether a great and important community like Liverpool is to be prevented from obtaining the first necessary of life—pure water—in order that the towns on the Severn may discharge sewage into it. We hear from one speaker that the flow at Worcester in dry weather is 90 million gallons per day, and that Liverpool proposes to reduce it by 40 millions. The fact is that when the River Severn is low at Worcester, the Vyrnwy is also low at Llanwddyn, and if the dry-weather yield from that branch of the Severn with which we propose to deal is, say, 4 million gallons per day, we propose to double it, so that the dry-weather flow at Worcester will be 94 instead of 90 million gallons. We hear from another gentleman that hidden streams have been discovered flowing under the sites of the proposed embankment, and it is evident from the two statements that a good deal of the threatened opposition arises from want of information as to the true character and effect of our scheme. I cannot repeat too often that the necessity for a new supply is urgent—so urgent that a year's delay may be most serious. We are passing through a cycle of wet seasons, which will inevitably be followed by a series of dry and warm years. I would appeal to the Council and to the public to remember that the responsibility of the water supply rests, in the first instance, upon the Water Committee; that the Committee have spared no pains or trouble to make themselves masters of the subject; that the administration of the water estate has been successful; and it is but reasonable to suppose that the members of the Committee, with the assistance of the first professional skill the country affords, must understand the subject better than those who have neither devoted to it the time and attention that the Committee have given, nor had the advantages that the Committee possessed; and I hope to find that the present appeal will show that the Committee have the confidence both of the Council and the public.

Mr. A. B. FORWOOD thought there were circumstances surrounding the scheme proposed by the Water Committee which rendered it highly improbable that they would be able to carry it through Parliament; further, it was not the best scheme that could be adopted, and besides it was one that must involve the ratepayers of the town in a large extra charge. Mr. Wilson said it would not entail a further cost to the ratepayers. He said the increase of revenue would go on at the rate of £5000 per annum, and that in ten years there would be an increment of revenue of £50,000. Surely he did not for a moment wish that if some time hence the Council had £50,000 more than they had that day, they should not reduce the water-rates. The saving from waste, the economy on the part of the

Committee—belonged to the ratepayers of the present day, and had no right to be kept in the coffers of the Water Committee simply for the purpose of gliding into a new scheme without their appearing to pay any extra charge whatever. The first year of the opening of a water scheme would cost them at the minimum £60,000 to £70,000 for interest and maintenance, whereas it would take 12 years before the increment of revenue overtook the interest and cost of maintenance. Mr. Wilson's remarks as regarded the Manchester scheme were also apt to mislead, and it was very erroneous to state that they were to pay half the full cost of any such scheme, *plus* the cost of the pipe line from Rivington. He (Mr. Forwood) had, however, another point, even more important, to urge on the Council and which was a strong reason for postponement. To his surprise, within the last few days it had come to his knowledge that there were 16 million gallons per day of the best water running through Whitchurch, and discharging itself into the River Mersey; and it simply required them to run a line of pipes from Liverpool to Whitchurch, or if they would to Middlewich, using the banks of the canal as way-leave, in order to have that water brought to Liverpool. He had heard the Bala scheme more than once mentioned in the Council, but he had always been told that there were insuperable obstacles in the way of adopting it, and so he did not pursue the matter further. But it appeared that Mr. Duncan, in his report in 1866, said that in his opinion, of all the schemes named, that which was the best adapted for Liverpool was Bala. Under the Act of 1804 the Shropshire Union Canal Company were only entitled to a limited and distinctly restricted use of the water for the purposes of navigation, subject to an obligation to return it again from the lake to the River Dee. But that was repealed, and there was now no obligation on the part of the Company to return into the Dee the water which they took from Bala. The Canal Company did not want the canal nor the 16 million gallons of water passing through it, and they would be willing sellers, and meet the Corporation in a liberal spirit. By bringing that water to Liverpool they would not be doing any wrong to the Dee, for the water was not abstracted from that river, and, therefore, they could not encounter any opposition on this score. Another point in connection with the scheme was that navigation purposes would be injured. If the Shropshire Union Canal Company were to oppose them in going to Bala, naturally they would get their 16 million gallons as the first take from the lake, and Liverpool would have to assent to the arrangement. But the Company did not want it, and were willing to dispose of all their rights over the canal; hence there would be no other claimants upon Bala Lake but the Corporation of Liverpool. The area of the lake was 1100 acres, and its depth was 40 feet; and there was not the slightest doubt that 26 million gallons of water could be obtained from it and the supply that was running through the canal. He hoped he had made out a *primâ facie* case that the matter required further inquiry and investigation from the Committee.

Mr. Yates held that after the previous resolution of the Council in favour of the Vyrnwy scheme it would be simply loyalty on their part to adopt that scheme. To his mind the proposition that Liverpool should be dependent upon Manchester for a certain portion of the water supply was most offensive. These recurring delays and oppositions and suggestions of new schemes irritated the public, and he thought they were damaging both the town and the public at large by keeping the subject floating before them.

Mr. M'Dougall said he would have no objection to go with the Water Committee if it could be understood that an arrangement should first be come to that the out-districts should pay equally with Liverpool.

Mr. Hughes said Mr. Wilson had told them that this scheme could be carried out without further taxation, but he (Mr. Hughes) thought something more was required, and that was that they should have a reduction of the present water-rates. It was true the Council had endeavoured to obtain a Provisional Order to raise the rates to the out-townships, but there were other injustices which ought to be dealt with. At the present time they were only receiving £20,000 for water used by the out-districts, but he did not hesitate to say that if the rates to those districts were placed on the same basis as those of Liverpool, the sum received would be £30,000.

Mr. Lewis said he did not consider that the Committee had devoted sufficient attention to the proposed joint scheme with Manchester. He could not understand why they had not come to some satisfactory conclusion with Manchester for turning into a second line of pipes at Rivington the additional quantity of water required by Liverpool.

Mr. J. B. Smith said this matter had been fully considered by the Committee. They went to Manchester, and the Chairman had told them what took place. The unanimous feeling of the Committee on their return was that nothing could be done with Manchester as that city was then situated. The first thing they were told was that Liverpool would be charged £11,000 a year for every million gallons of water taken, so that if they wanted 5 million gallons a day they would have to pay £55,000 a year, which was almost what the Vyrnwy scheme would cost. The Manchester Corporation said further that no doubt if the scheme were fully developed it would be very hard upon them that they should be compelled to charge less for the water. But the Manchester people said in the first instance that they were not wanting water for a very long time.

Dr. Cross adduced figures which, he said, showed that the yield of the new Bootle bore-hole was increasing. He advocated a further supply from the Rivington district.

Mr. Bower said the information he had showed that the decrease in the old well at Bootle was at a greater rate than the increase in the new bore-hole. With regard to Bala, it was a fact that the moment the water flowed over the present embankment the cellars in Bala were flooded. They might judge from that what would be the effect if they raised the embankment 3 feet higher. He contended, further, that a fall of 2 feet per mile would not do for pipes, but was only sufficient for aqueducts or culverts. In his report of 1866, Mr. Duncan condemned the scheme which Mr. Forwood now introduced.

Alderman Samuelson said no further delay ought to be tolerated, and the Committee should be strengthened in their efforts to procure a good and sufficient supply of water for the town. As to the water question being more a national one, if all the large Municipalities looked after themselves as Liverpool was doing, the nation need not interfere.

Alderman Bennett remarked, with regard to the Bootle bore-hole, that it had been said it had turned out a failure, and meant the throwing away of £20,000; but that was not so. It had been proved that the deeper they went the softer the water became, and that a certain amount of water had come up from the first time of the pumping, which quantity was gradually increasing. He had very little doubt that in a short time, when the fissures became clear of the sand with which they were charged, the quantity expected would be found there. He expressed a hope that the Vyrnwy question would be delayed for a couple of years, and by even a short delay they could arrive at facts which would perhaps save the town a very large sum of money. If they, by a large majority, decided that the Vyrnwy scheme should be gone on with, then they would put the town to the immense expense of a poll.

Mr. Radcliffe said that Alderman Bennett was tempting Providence when he succeeded in having the bore-hole placed beside the existing Bootle well. There was plenty of water in the red sandstone in the neighbourhood of Liverpool, and if a bore had been sunk somewhere between Fazakerley and Knowsley an ample supply could have been obtained. The fact was that the Manchester proposition was not well considered by the Committee. But, under all the circumstances, and considering the immense difficulties they would have to encounter in Parliament, he thought they ought to delay the Vyrnwy scheme. They could well afford to do so. Their rates in Liverpool were now 5s. 6½d. in the pound, whilst in Manchester they were only 4s. 2d. If they added the interest of the money that would be spent in two years, in the event of the Vyrnwy scheme being launched, it would bring the rates up to 6s. in the pound, and that was a consideration, in addition to which the question of utilizing the water they had by sinking more wells and that of a national supply should be weighed.

Mr. Ball said he felt so much the importance of the statements of Mr. Forwood as to the Bala scheme, that he thought it would be far better to postpone the question for a short time than arrive at a premature conclusion without those statements being proved to be unfounded.

The Mayor said that he had a great objection to addressing the Council on matters of debate, but after all that had been said he could not give a silent vote, especially after what had fallen from Mr. Forwood with reference to the new proposition as to Bala. He did not share Alderman Bennett's profound confidence in the wells. The Committee had done all that Mr. Bennett desired; he selected his own place for the bore-hole, and if the water was not there at present there was very little probability that it would be found there in the future. With regard to Manchester, he must object entirely to the remarks of Mr. Radcliffe. When they went to Manchester they did all they could to put themselves in as favourable a light as possible, and the Manchester people behaved in the most friendly and generous spirit. But as thorough men of business the Manchester authorities explained to the deputation that they found themselves in a very much better position with regard to a water supply than Liverpool did. At present they were in no hurry; they had obtained their Act without limitation of time, and therefore they should proceed as best suited their own interests. Liverpool would have to pay £10,000 or £11,000 per million gallons of water to be taken at a time that the Manchester people could not name. Upon this the Water Committee felt it was of no use discussing the matter further. Then they were asked if they would be prepared to entertain any inducement for hurrying forward their works, and they found it would be such as would involve them in pretty nearly as large an amount per annum as would positively provide Liverpool with an unlimited supply from the Vyrnwy. With regard to the proposition of Mr. Forwood, on looking into it he found it was utterly unsuitable and unreliable for Liverpool; and he hoped that the Council, having decided that the Vyrnwy scheme was the best, would now place it before the ratepayers, in order that they might form their own opinion upon it.

The Council then divided, and the motion was carried by 33 votes to 13.

A meeting of the Liverpool Land and House Owners Association was held on Friday, the 3rd inst., when the following resolution was unanimously adopted:—"This conference respectfully and urgently request that the Town Council refuse to sanction the promotion of a Bill in Parliament next session for powers to obtain a supply of water from the Vyrnwy, and that the memorial read, urging the postponement of the Vyrnwy scheme, be adopted."

The following is a copy of the memorial, which was presented at the Town Council meeting reported above:—

That your memorialists have had under consideration the resolution of the Town Council to proceed to Parliament in the next session for a new scheme to bring water from the River Vyrnwy.

Your memorialists, without offering any opinion on the merits of this scheme, respectfully ask for its postponement until the Government shall have declared their views with reference to a national scheme.

Your memorialists find that the Water Engineer has estimated that it will cost £1,187,709 to produce the first instalment of his scheme of 13 million gallons per day, the interest upon which for one year at 4 per cent. is £47,508. And as there is no pressing necessity for a further supply of water, the saving of this large sum even for one year will be a great boon to the ratepayers.

Your memorialists would remind the Town Council that the Prince of Wales and the Society of Arts are very greatly interesting themselves in favour of a national water supply; that a very numerous and influential deputation is being organized from the Severn Commissioners, and from all the towns and localities along the line of the Severn, from Montgomeryshire to Bristol, among whom are 110 Members of Parliament, the object being to press upon the Government the importance of proceeding with a national water scheme. It would be a graceful act if Liverpool were to form part of the deputation, and thereby add to the weight of the same.

Your memorialists affirm that London and Liverpool would gain very much from a national water supply. London would get a water under 2° of hardness instead of 17°. If the cost of the works by Government be taken out of the national taxation, instead of from taxation yielded under the poor-rate assessment, the water-rate would be only one-sixth the sum now contemplated by the Town Council; for example, to yield the above £47,508 under the poor-rate assessment, a rate of 4d. would be necessary, whilst under a scheme of national taxation a rate of ⅔d. in the pound would be sufficient.

A national water scheme would bring the best waters from great distances to convenient water centres, so as to be reached from the centres of great populations without much expense, and thereby reduce the cost of a water scheme. As all works undertaken by Government would come out of national taxation, it is greatly to the interest of the ratepayers to wait and to urge the Government to proceed with a comprehensive scheme without delay.

Your memorialists would urge other reasons in favour of a postponement of the Vyrnwy scheme. The Duke of Richmond and Gordon has carried through the House of Lords his Conservancy of Rivers Bill, which provides that each district should have the sole and entire control of its own watershed through properly-appointed Commissioners; and that, in all probability, this Bill will become law before the Vyrnwy Bill could be got through a Committee of the House of Commons. Then there is the great opposition hereinbefore referred to; besides, the Home Secretary has promised to deal with the water question for London next session, and great pressure from a numerous and influential deputation will force him to decide upon the question of a national water supply.

The Town Council have already gained much by delay. The Vyrnwy scheme is about the sixth taken up in turn, and the Town Council seem to consider it the cheapest and best. A little further delay might result in some scheme even still better. It is thought that the Thirlmere water may be had at a less cost than the Vyrnwy; also, that it is possible that the Bala water may be brought to Liverpool at a less cost.

Your memorialists therefore respectfully request that the Town Council will not promote a Bill in the next session of Parliament for the Vyrnwy scheme of water supply.

(Signed) Walter Pierce, President.

Liverpool, Oct. 3, 1879.

A public meeting of owners and ratepayers of Liverpool was held last Thursday, for the purpose of consenting or otherwise to the promotion of the Bill in Parliament agreed to by the Town Council at their meeting reported above. The Mayor presided, and proposed the necessary formal resolution, which was discussed at great length, and eventually rejected by a considerable majority. A poll was, of course, demanded on behalf of the Corporation, and will in due time be taken.

A meeting of the Liverpool Land and House Owners Association was also held last week, with respect to the Vyrnwy scheme, when the following motion was unanimously adopted:—"That this Association do adopt such legitimate means as may be necessary to oppose the Corporation in promoting a Bill in the next session of Parliament for a supply of water from the Vyrnwy."

Filey Gas and Water Company.—At the last annual general meeting of this Company a dividend of 6 per cent. was declared.

LONDON GASLIGHT COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Wednesday, at the Freemasons Tavern, Great Queen Street—the GOVERNOR (Major Rohde Hawkins, Esq.) in the chair.

The SECRETARY (Mr. A. J. Dove) having read the notice convening the meeting, the corporate seal of the Company was affixed to the register of Proprietors, and the following report and accounts were presented:—

The accounts annexed to this report show the result of the manufacture and distribution of the Company's gas for the half year ending June 30, 1879.

It will be seen, on comparing these accounts with those of the corresponding period of 1878, that there is a considerable increase in the rental for gas, and also in the returns for the other products. The exceptional character of the season will, no doubt, account, to some extent, for this increase; but it is also found, from later returns, that a considerable portion of the improvement is of a permanent character. The gas-rental has increased by £11,901 6s. 7d., and the other products by £6389 19s. 8d. A saving has also been effected in the cost of coal.

The Company has not been inconvenienced by the difficulties which arose during the past winter between the Durham colliery proprietors and their workmen, the Contractors having carried out their engagement with great zeal.

A third steamship has been engaged to convey coals without transhipment to the Company's works.

After making provision for the interest and dividends on preference capital, there will remain, to meet the dividends on the ordinary capital, £22,468 13s. 11d., out of which the Directors recommend that the usual dividend at the rate of 10 per cent. per annum be declared—the several dividends to be paid on Oct. 15, 1879.

The Bill in Parliament, promoted by the Company, referred to in the last report, and sanctioned at an extraordinary meeting of Proprietors held on the 2nd of April last, has been withdrawn, the Directors not thinking it prudent to incur the expense of a contest to obtain the objects sought by the Bill.

The Directors regret to have to announce the death of one of your Auditors, Hugh Oxenham, Esq., who has efficiently filled the office for nearly nine years. The vacancy thus created will have to be filled up at the present meeting by the appointment of a Proprietor to the office.

No. 1.—STATEMENT OF STOCK AND SHARE CAPITAL, *on June* 30, 1879.

Acts of Parliament relating to the Raising of Capital.	Description of Capital.	Maximum Dividend authorized.	Number of Shares issued.	Nominal Amount of Shares.	Called up per Share.	Total paid up.	Arrears of Calls.	Remaining to be called up.	Total Amount authorized.
15 Vict., cap. 82	Ordinary stock.	10 per cent.	Stock	Stock	Stock	£387,800	..	..	£387,800
	2nd pref. ,,	6 ditto.*	Do.	Do.	Do.	7,350	..	..	7,350
	3rd ditto ,,	6 ditto.*	Do.	Do.	Do.	2,000	..	..	2,000
	1st ditto ,,	6 ditto.	Do.	Do.	Do.	150,000	..	..	150,000
29 Vict., cap. 55.	A ditto shares	6 ditto.	12,000	£25 0 0	£20 and £1 5s.	186,942	..	£113,058	300,000
20 & 21 Vict., cap. 73	1 & 2 Deb. stks.	6 & 5 ditto.	Stock	Stock	Stock	26,655	..	..	26,655

* With option of conversion.

No. 2.—STATEMENT OF LOAN CAPITAL.

Acts of Parliament authorizing the Loan Capital.	Description of Loan.	Rates per Cent. of Interest.		Total Amount borrowed.	Remaining to be borrowed.	Total Amount authorized.
		4½ per Cent.	5 per Cent.			
15 Vict., cap. 82	Bonds, 4½ per cent.	£91,862	£7,687	£99,549	£79,305	£91,667
29 Vict., cap. 55	Debenture stock, &c.					100,000

No. 3.—CAPITAL ACCOUNT.

Dr. Cr.

—	—	Description of Capital.	Certified Receipts to Dec. 31, 1878.	Received since that date.	Total Receipts to June 30, 1879.
To Expenditure to Dec. 31, 1878	£831,535 3 10	By Ordinary stock	£387,400 0 0	£400*	£387,800 0 0
Balance	10,605 12 6	2nd Preference ditto.	7,750 0 0	†	7,350 0 0
Total expenditure.	£842,140 16 4	3rd ditto ditto.	2,000 0 0	..	2,000 0 0
Balance	18,156 6 2	1st ditto ditto.	150,000 0 0	..	150,000 0 0
		A ditto shares, £25 each, including amount received in anticipation of calls	186,622 10 0	320 0 0	186,942 10 0
		1st & 2nd Debenture stocks, under 20 & 21 Vict., cap. 73	26,692 12 6	‡	26,655 12 6
		Bonds, &c.	72,987 0 0	¶	68,987 0 0
		4½ per cent. debenture stock	30,562 0 0	..	30,562 0 0
	£860,297 2 6		£864,014 2 6	..	£860,297 2 6

Note.—* † Converted into ordinary stock, £400. ‡ Redeemed, £37. ¶ Paid off, £4000.

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—			
Coals, including dues, carriage, unloading, and trimming (see statement No. 8)	£55,478 0 10		
Salaries of Engineers, Superintendents, and other Officers at works	2,142 7 5		
Wages (carbonizing)	11,414 18 11		
Purification, including £1118 5s. 4d. for labour	2,172 4 9		
Repairs and maintenance of works and plant, materials, and labour, less £221 11s. 8d. for old materials	20,670 7 6		
		£91,877 19 5	
Distribution of gas—			
Salaries and wages of Officers (including Rental Clerks)	£2,352 10 3		
Repairs, maintenance, and renewals of mains and service-pipes, including labour	9,314 11 2		
Repairs and renewals of meters	1,624 11 2		
		13,291 12 7	
Public lamps—			
Lighting and repairing		1,479 15 11	
Rents, rates, and taxes—			
Rents payable	£918 14 0		
Rates and taxes	4,704 8 10		
		5,623 2 10	
Management—			
Directors allowance	£1,250 0 0		
Company's Auditors	75 0 0		
Salaries of Secretary, Accountant, and Clerks	1,302 2 7		
Collectors commission	2,065 7 2		
Stationery and printing	419 15 8		
General charges	522 6 4		
		5,634 11 9	
Law charges		587 17 11	
Parliamentary charges (oppositions)		48 3 2	
Bad debts		518 12 0	
Depreciation-fund for works on leasehold land		100 0 0	
Superannuations, sick allowances, and gratuities		610 7 7	
Repairs of houses		23 12 7	
Total expenditure		£119,795 15 9	
Balance carried to net revenue account, No. 5		36,380 11 4	
		£156,676 7 1	

By Sale of gas—			
Common gas, per meter, at 3s. 3d. per 1000 cubic feet		£107,327 7 2	
Public lighting, and under contracts—			
Common gas (See statement No. 10.)		9,999 6 1	
		£117,326 13 3	
Rental of meters		2,185 5 9	
			£119,511 19 0
Residual products—			
Coke, less £2206 12s. for labour and cartage		£21,379 5 0	
Breeze, less £315 9s. 2d. do.		1,431 11 6	
Tar, less £18 1s. 8d. do.		5,877 11 11	
Ammoniacal liquor, less £24 4s. do.		7,060 11 2	
			35,748 19 7
Rents receivable			1,399 16 0
Transfer fees			15 12 6
			£156,676 7 1

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).

Interest on bonds, 4½ per cent. debenture stock, &c., to June 30, 1879	£2,286 17 0	Balance from last account	£26,481 10 6
Dividends on preference capital	11,133 7 9	Less dividend on ordinary capital for the half year ending Dec. 31, 1878	19,370 0 0
	£13,420 4 9	Amount carried to reserve-fund to Dec. 31, 1878	£7,111 10 6
Interest on temporary loans	241 12 8		
Redemption-fund, reserve per London Gaslight Act, 1857	750 0 0	Amount from revenue account, No. 4	£36,880 11 4
Balance applicable to dividend on ordinary capital	22,468 13 11		
	£36,880 11 4		£36,880 11 4

No. 6.—RESERVE-FUND.

Balance on June 30, 1879	£69,260 11 4	Balance on Dec. 31, 1878	£61,209 1 5
		Interest on amount invested	939 19 5
		Amount brought from net revenue account for the year 1878	7,111 10 6
	£69,260 11 4		£69,260 11 4

No. 7.—DEPRECIATION-FUND (FOR WORKS ON LEASEHOLD LAND).

Balance on June 30, 1879	£2,145 4 0	Balance on Dec. 31, 1878	£2,015 1 4
		Interest on amount invested	30 2 8
		Amount brought from revenue account for the half year ending June 30, 1879	100 0 0
	£2,145 4 0		£2,145 4 0

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, Dec. 31, 1878.	Received during the Half Year.	Carbonized during the Half Year.	Used for Sundries during the Half Year.	In Store, June 30, 1879.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common	7,085	77,543	72,689	35	11,904
Cannel	944	4,202	3,562	..	1,584

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

Description of Residual.	In Store, Dec. 31, 1878.	Made during the Half Year (estimated).	Used during the Half Year (estimated).	Sold during the Half Year.	In Store, June 30, 1879.
Coke, chaldrons of 36 bush.	2,200	74,297	19,984	54,693	1,820
Breeze " " "	523	9,507	..	9,107	923
Tar, gallons	240,000	705,751	..	895,751	150,000
Am. liqr., butts of 108 gals.	1,482	17,166	..	18,444	204

No. 10.—STATEMENT OF GAS MADE, SOLD, &c.

Description of Gas.	Quantity made (measured by Station Meters).	Quantity Sold.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	754,570	49,405	660,475	709,880	8,267	718,147	36,423	5,288

BALANCE-SHEET.

To Capital—				By Cash at Bankers, and in hand		£17,752 3 6
For balance, per account No. 3		£18,156 6 2		Amount invested—		
Net revenue—				Reserve-fund	£69,260 11 4	
For balance, per account No. 5		22,468 13 11		Redemption-fund	7,890 0 6	
Reserve-fund—				Unclaimed dividends	4,871 2 7	
For balance, per account No. 6		69,260 11 4		Depreciation-fund (for works on leasehold land)	2,045 4 0	
Depreciation-fund (for works on leasehold land)—				Stores on hand, viz.—		83,566 18 5
For balance, per account No. 7		2,145 4 0		Coals	£11,443 19 11	
Redemption-fund		8,140 0 6		Coke and breeze	856 8 4	
Bond, 4½ per cent. debenture stock, &c., interest for amount due to June 30, 1879		1,478 16 0		Tar and ammoniacal liquor	1,093 15 0	
Preference dividends, ditto		11,133 7 9		Sundry stores	4,079 13 8	
Unclaimed dividends		5,397 16 3		Accounts due to the Company—		17,483 16 11
Sundry tradesmen and others, for amount due for coals, stores, and sundries		39,978 6 9		Gas and meter rental, quarter ending June 30, 1879	£36,946 11 8	
				Ditto arrears outstanding	5,672 19 3	
					£42,619 10 11	
				For coke and other residual products	14,727 14 5	
				Sundries	2,008 18 6	
						59,356 3 10
		£178,159 2				£178,159 2 8

The GOVERNOR said: As we have had the pleasure of showing you for some half years past, we are still doing a prosperous business. Our works are in very good order, and our business is rapidly advancing. The increase last half year over the corresponding half of 1878 amounted to something like 18 per cent. A great deal of that, no doubt, is due to the exceptionally cold and dull weather, especially the dull weather we have had now for several months past; but we have very good reason to know that there is also a permanent increase—probably as much from the consumption of gas for warming, cooking, and engine purposes, as for lighting; and it is when one sees an opening for the extensive employment of gas for these special purposes that one looks on anything like the introduction of the electric light with great equanimity, because we feel that there is a very vast field for the use of gas which at present has hardly been opened up at all. Therefore, I confess that I have no anxiety for the future; on the contrary, we have seen the electric light in operation for some months, and yet we know that the consumption of gas increases very largely, and I am happy to say that during the current half year—of which we have had experience for three months—the increase of the last half year is very nearly maintained. Of course, during the summer there is brighter weather, and therefore exceptional causes do not so much exist; but even at the present time the increase is very considerably in excess of what it has ever been before. You see that the rental has increased, and I am happy to say that the result of the sale of our residual products is very satisfactory, and it is the more so because we have increased receipts from residuals to the extent of more than £6000, while our friends The Gaslight and Coke Company in their last report lamented a loss of £50,000 upon that part of their business during the same period. You observe that we have inserted a paragraph in the report with regard to our supply of coals. We think it only due to our contractors, Messrs. Bowes and Co., with whom we have done business now for a great many years, to recognize the exertions they made in order that we should not suffer from the great strikes that recently took place in the North. We sustained no loss, while our friends of The Gaslight and Coke Company suffered to the extent of £17,000. Of course, these sums sound very large in proportion to our business. Their business is ten times as much as ours; the diminution in their receipts from products would represent a loss of £5000 to us, and the diminution of £17,000 would be a diminution of £1700 with us; but it is satisfactory to know that we have not lost £1700 on our coals, and that the residual products gave us a comparative gain, instead of a loss, of £6000; so I think we can flatter ourselves, comparing ourselves with our neighbours, that we are in a very good way. The only other point I need mention—and it is hardly necessary, only that the Governor of The Gaslight and Coke Company did so at their meeting—is with reference to certain negotiations for amalgamation. All I can say is, that we had some negotiations about it. We looked into it, and we thought that the terms offered were not such as we could ask the Shareholders to accept. We have a very high opinion of the value of our property, and as Directors we should have failed in our duty to you if we had asked you to accept anything less than a fair and thoroughly good price for it. If people want to buy us, they must pay for us. With these few remarks, I will move—"That the report of the Directors and the accounts be received and adopted."

Mr. W. IRVING HARE seconded the motion, which was at once carried unanimously.

The GOVERNOR then moved the payment of the dividends referred to in the report.

Mr. JULAND DANVERS seconded the motion, which was also carried unanimously.

The GOVERNOR said: Since our last meeting, gentlemen, we have had to regret the death of one of our Auditors (Mr. Oxenham), who has acted as Auditor for some time past. It is necessary to-day that an Auditor should be elected, but that is a matter which rests entirely with the Shareholders. An Auditor is a sort of assessor, to look after the Directors, and see that they do not misspend your money; so that it is for you to select a successor to co-operate with the other Auditors in examining the accounts.

Mr. S. ADAMS BECK said he had much pleasure in proposing Mr. Arthur J. King as Auditor. He had known Mr. King for many years, and his first acquaintance with that gentleman arose under rather peculiar circumstances. When he (Mr. Beck) was Governor of the Chartered Company, he (Mr. King) came and criticized the accounts. He criticized the accounts severely, but with all his criticism he could not discover anything that was wrong. He had also known Mr. King for many years as Secretary of the Ottoman Gas Company.

Mr. A. F. WILSON seconded the motion.

A SHAREHOLDER thought it very essential that a good man should be appointed to the post, and would like to know whether Mr. King's candidature was satisfactory to the Board.

The GOVERNOR: We know Mr. King, and think very highly of him; but independently of any opinion we may have to express on the matter, when I find Mr. King has as his friends Mr. Beck, formerly Governor of the Chartered Company, Mr. Horner, Chairman of the Phœnix Company, and Mr. Stephenson Clarke, I think it is sufficient.

The motion was unanimously agreed to.

Mr. KING expressed his obligation to the Proprietors for his election, and his gratification at finding himself among them once more. This was the first Company he was ever connected with, now more than 20 years ago, and perhaps it would have been as well had he never left it. He was extremely gratified to find that he possessed their confidence.

The GOVERNOR then drew attention to a map fixed to the wall, showing the various districts of the Metropolitan Gas Companies, and which he said he promised at the last meeting should be brought on the present occasion.

Mr. FORD proposed a vote of thanks to the Governor and Directors. He referred, he said, on the last occasion, to negotiations with The Gaslight and Coke Company for an amalgamation with this Company. It was his intention on the present occasion to make some observations with reference to the amalgamation, which he thought must eventually be brought about with respect to the Metropolitan Gas Companies; but the death of his friend Mr. Oxenham, and his own absence from town, had prevented him from obtaining that statistical and other information which would alone have justified him in bringing the matter forward in a formal manner before the Proprietors. Reference had been made by the Governor to some negotiations of a somewhat informal character which had taken place, as he understood, between the Directors of the Company and the Directors of The Gaslight and Coke Company, but the Governor did not state the particulars of those negotiations—what the proposals were, or what were the points of difference between them—as to which he had no doubt the Proprietors would have been very happy to have formed an opinion of their own, however much confidence they had in the management of the affairs of the Company. It appeared to him that the Shareholders had a perfect right to form their own opinions on this subject, but perhaps the Governor was not disposed to give the details at a public meeting. He, however, presumed that the Governor would have no objection to state to any Proprietor who called at the offices, what the negotiations generally were, so that the Proprietor might, if he thought proper, be enabled to make some suggestions with respect to the subject. He merely mentioned this now, because it was certainly his intention to call on the Governor and ask him to state generally what the points of difference were, so that if he brought the matter formally before the Shareholders, he might be able to tell them clearly what his own opinion was as to the principle on which amalgamation should take place.

Mr. NORTHOVER, in seconding the vote, said there were certain points which struck him in respect to amalgamation. Advantages would accrue from economy in respect to expenses, but he should like to look at the side most favourable to them as Shareholders, and that most favourable side seemed to him this—that they exchanged their 10 per cent. for 10½ or 11 per cent. That, he thought, was as much as they could expect by the exchange. But there was another point for consideration. They must remember that when they amalgamated they were always viewed with some suspicion by the public. Therefore, before they took the leap, he would say, "Be careful." They were now earning their money regularly and well, and everything was so satisfactory that not one gentleman rose to criticize the accounts. He had himself intended to ask a question in respect to repairs and maintenance, which item seemed exceptionally large; but he could anticipate the answer—that it was necessary to keep the works in good order; and, therefore, he apprehended that there was nothing to be said in respect to the accounts. Then there was another question. Last year they had among them Mr. Leng, a gentleman from Dundee, who referred at some length to the electric light. As to that, they were now in a different position; they could afford to laugh at the electric light. Where was Mr. Edison? Lost in obscurity, and the very thing with which he was going to put gaslight out, as they might read in the last number of the JOURNAL OF GAS LIGHTING, was published 30 years

ago in the *Family Herald*. After quoting the extract, he observed that Mr. Staite's light was regular, and at the time the paragraph was written respecting it, it was expected that the days of gas were numbered. That was 30 years ago; it did for now, and it would do 30 years hence; and he could not think they had anything to fear in respect to it.

Mr. SLATER, after stating that he attended a gas company's meeting in a provincial town the previous Wednesday, asked what price the Company were now charging for gas.

The GOVERNOR: 3s. 3d. per 1000 feet.

Mr. SLATER said in the town to which he referred they were charging 2s. 4d. per 1000 feet to their smallest consumers, 2s. 2d. to their medium-sized consumers, and 2s. to their largest consumers, though, to be sure, that was in the midst of a coal district, and he quite believed the position of the Company now depended on supplying the public well. He had not sold his shares when the electric light "scare" occurred, but at the same time he urged the Shareholders not to laugh at the light. If they felt inclined to do so, let them go to Aldersgate Street station. He was there on the previous evening, and expected, as on former occasions, to go down into some dark hole; but he was considerably astonished to find himself comparatively in daylight, on account of the electric light. That light would never frighten him, but it would be very unadvisable to ignore it. Let the Company give the public the best possible gas at the lowest price they could, subject to the dividend, to which, indeed, the Shareholders were fairly entitled. There were those who held shares who formerly received no dividend, and they were, therefore, entitled to their reward; but he would urge the Company to serve the public well. The electric light was not to be ignored, for it might become a very substantial reality.

Mr. FORD remarked that steam was laughed at for very many years before it came into use on railways.

The GOVERNOR: Yes, but it did not decrease the number of horses in use. He added: Of course, Mr. Ford, or any Shareholder, is quite at liberty to call at the offices, and I will explain what my views are as to the question of amalgamation; but you must understand that in your own private matters you do not discuss the *pros* and *cons* of your affairs with the public. It would not be at all wise to discuss the minute details of these negotiations before a large body of Shareholders. You may depend upon it that none of these matters have been slurred over by the Directors. We have taken the subject into careful consideration. There are a great many difficulties in the way, and at present the terms offered are not those which I think our business is worth, and I believe I can show Mr. Ford that the concern is worth more than the amount that we have been offered. That is with regard to the advantages as they affect us. With regard to the advantages to the public, I may say that our price is as low, and our gas is as good as any one else's; so there is nothing to be gained by the public in that direction.

Mr. Ford then put the resolution, which was carried unanimously.

The GOVERNOR: I have to express our thanks for the consideration you have shown to the Directors. We have done the best we can, and we shall continue to do the best we can for the Company. Before you separate, allow me to propose a vote of thanks to the Secretary (Mr. Dove), Engineer (Mr. Morton), and other Officers of the Company. I need scarcely say how much we are indebted to them, because it is really to them that we are mainly indebted for the very satisfactory statement we present. I therefore beg to propose a vote of thanks to the Secretary, Engineer, and the rest of our Officers.

The motion was seconded and carried unanimously, and the meeting then separated.

SALE OF SHARES IN THE SOUTH SHIELDS GAS COMPANY.

Last Wednesday the first portion of the capital authorized to be raised by the South Shields Gas Act of last session was offered for public competition—the Auctioneers being Messrs. T. GLOVER AND SON. The amount offered—viz., £10,000—was divided into lots of £10 each. The Act provides for a dividend of 7 per cent. being paid with a standard price, under the sliding scale, of 3s. 3d. per 1000 feet within the boroughs of South Shields and Jarrow and the district of the Local Board of Hebburn, and 4s. per 1000 feet beyond.

Mr. W. GLOVER, before commencing the sale, said there was no doubt the country had passed through times of depression, anxiety, and difficulty in business matters, so that it was very refreshing to turn to such a concern as the South Shields Gas Company. The Company had been in existence something like 55 years, during which time their history had been one of steady and constant progress, and the management had been exceedingly good throughout the whole period. They were very glad that Mr. R. Wallis, the Chairman of the Company, was present that day, full of health and energy, and likely to give the same assistance which he had hitherto done as Chairman of the Company, and he only spoke the sentiments of every Shareholder, as well as inhabitant of South Shields, when he said that Mr. Wallis was highly respected by all classes. The whole of the Company's works had been brought to a state of great perfection through the efforts of the present Engineer, Mr. W. J. Warner, who enjoyed the respect and confidence of the Directors, and there was no doubt he would be prepared to give the same attention to the interests of the Company in the future as he had done in the past. Mr. Warner, he might state, had been the originator of many improvements which had proved most important in connection with the manufacture of gas. As he (Mr. Glover) believed, they had passed low-water mark, and things were improving, and he was certain South Shields would be one of the first places to feel the benefit of the improved state of matters, so that he submitted the stock of the Company with every confidence.

The sale, which lasted less than half an hour, resulted in the disposal of £8330 of the amount offered. The prices realized were—£13 17s. 6d. each for 35 shares; £13 each for 10 shares; £12 12s. 6d. each for 268 shares; £12 12s. each for 10 shares; and £12 10s. each for 510 shares—giving a total of £10,500 for the 833 shares sold.

KINGSTON (JAMAICA) GAS SUPPLY.

We have recently received a copy of a report, dated July 26, made by Mr. G. N. Cox, A. Inst. C.E., Engineer of the Kingston (Jamaica) Gas-Works, addressed to the Managing Commissioner, on the results of the working for the twelve months ending 30th of April last.

From the carbonizing returns it would seem that 6,021,430 cubic feet of gas were made, of which quantity 6,019,719 feet were delivered. The amount of coal carbonized amounted to 221 tons of cannel, and 385 tons of common, of a total value of £986 14s. The further amount expended in labour, lime, and repairs to retorts amounted to £1141 2s. 4d., giving an average cost of production of about 7s. per 1000 feet. If, however, the cost of management be added, it is found that the total cost of producing the gas amounted to 10s. 6d. per 1000 feet. The average production of gas per ton was 9936 feet—a very favourable result, considering that some of the coal used had been in store for two years. The illuminating power of the gas, as tested by one of Sugg's "London" standard burners, ranged between 18 and 20 candles.

During the twelve months 37 meters were fixed, and 566 lights fitted up, as compared with 52 buildings, with 1101 lights, fitted up in the previous year. The value of the fittings sold, together with the cost of fitting the same, £982 0s. 1d., or an average of 34s. 8d. per light.

The quantity of tar made during the year amounted to 6700 gallons, of which 2351½ gallons were sold at rates varying from 6d. to 1s. 6d. per gallon. The total sum realized was £71 4s. 9d., as against £31 5s. 3d. in the previous year. The quantity of coke produced was 398 tons, of which 306 tons were used in the retort and boiler houses. This is a large proportion, but it is rendered necessary, the report states, from the peculiar condition under which the gas supply is carried on in Kingston. The quantity of gas used per night varies from 23,000 cubic feet on dark nights to 8000 feet on moonlight nights, when no street-lamps are lighted. It is necessary, however, to keep up the retorts at the same heat, and, therefore, the same quantity of coke is used when little gas is manufactured as when the works are in full swing. This evil will, however, remedy itself in course of time, as the supply to private consumers becomes greater, and Mr. Cox trusts this year to reduce the proportion of coke used compared with coke made to 50 per cent.

During the whole twelve months there was a fair demand for coke, and the prices realized were from 25 to 50 per cent. greater than in the previous year. The price now charged is 20s. per ton, or 1s. 3d. per cwt., compared with 40s. in Havana, 40s. in Santiago, and 28s. in Georgetown. The value of the coke sold was £125 12s. 7d., against £71 4s. 9d. for the previous year. There were 918 barrels of lime used for purification, the whole being burnt on the works. Lime was sold to the value of £36 3s. 10d., as compared with £15 3s. 6d. for the first year.

Consumption of gas in public and private dwellings showed an increase in 1878-79 over 1877-78 from 762,200 feet to 2,072,300 feet; or, in money value, from £571 13s. to £1554 4s. 6d. It is estimated that the street-lamps, which were lighted for a total period of 2269½ hours, consumed 3,404,250 cubic feet. This, added to that consumed in public and private buildings and at the gas-works, amounts to 5,599,650 cubic feet, showing a loss by leakage and condensation of 422,780 feet, or 7 per cent.

The following is a statement of the value of the gas consumed, together with the value of the residuals and fittings sold last year, as compared with the preceding twelve months:—

	1878-79.		1877-78.
In 300 street-lamps, at £8 per annum	£2400 0 0	..	£2333 6 8
In public and private buildings	1554 4 6	..	571 13 0
Coke sold	125 12 7	..	55 19 0
Tar sold	71 4 9	..	31 5 3
Lime sold	36 3 10	..	15 3 6
Meter hire	15 8 6	..	7 8 10
Rental of fittings	15 0 3	..	2 8 9
Fittings sold	917 10 8	..	2011 17 3
Totals	£5135 5 1	..	£5029 2 3

The following table shows the comparative expenditure for the two years 1878-79 and 1877-78:—

	1878-79.		1877-78.
Coals	£986 14 0	..	£951 12 3
Wages and renewals	810 16 4	..	606 1 5
Street lighting	276 19 8	..	249 18 8
Lime	112 11 7	..	176 16 6
Gas-fitting	982 0 1	..	1553 4 4
Salaries	796 16 4	..	721 9 0
Miscellaneous	258 13 11	..	207 11 0
Totals	£4224 11 11	..	£4466 13 2

From the financial statement prepared in the Treasury up to Dec. 31, 1878, it seems that the liabilities amounted on that date to £38,260. Of this amount £30,000 was raised by debentures bearing 5 per cent. interest, and the balance is made up by advances from the Treasury, also bearing 5 per cent. interest. These advances were necessary for the purchase of coals, meters, and gas-fitting stock (the value of the stock on hand on Dec. 31, 1878, amounted to £4883 12s. 8d.), and for the payment of interest on the debentures during the progress of the works, and before they became reproductive.

Mr. Cox concludes his report in these words: "It is to be regretted that the increase in the number of private consumers is so small, but an impression seems to prevail that an exorbitant price is charged for gas—much higher than in other towns similarly situated to Kingston. To remove this impression, I subjoin a statement showing the rates charged at the undermentioned places:—

Kingston, Jamaica	15s.	per	1000	cubic feet
Georgetown, Demerara	15s.	,,	,,	to small consumers
,, ,,	12s.	,,	,,	to large ,,
Bridgetown, Barbadoes	15s.	,,	,,	with 20 per cent. discount for prompt payment.
St. Thomas	15s.	,,	,,	
Havana	20s.	,,	,,	
Santiago de Cuba	24s.	,,	,,	
Panama	24s.	,,	,,	
Wellington, New Zealand	15s.	,,	,,	with a discount of 4s. for prompt payment.

"Even in the United States, where coal is plentiful and cheap, the price varies from 8s. to 16s. per 1000 cubic feet. An impression also seems to prevail that the cost of introducing gas into a dwelling is very great, but this is by no means the case, the absolute cost of its introduction averaging 10s. per light. To encourage the consumption of gas in Kingston, I have imported a cheap description of gas-fittings, and have also made arrangements to rent out fittings and cooking-stoves to those consumers who either cannot afford or do not care to go to a considerable outlay at once in fitting up their houses. To produce a light equal to that given by the combustion of 1000 cubic feet of gas, costing 15s., would require:—

47 lbs. of tallow candles, at 6d. per lb.	£1 3 6
40 lbs. of composition candles, at 1s. per lb.	2 0 0
5½ gallons of colza oil, at 5s. per gallon	1 7 6
6 gallons of kerosene, at 2s. per gallon	0 12 0

It will thus be seen that gas, even at 15s., is considerably cheaper than any other illuminant, with the exception of kerosene oil, and if the cost of broken chimneys, lamp-wicks, and oil stolen by servants be taken into account, it is doubtful whether gas is not cheaper even than petroleum."

ILKESTON LOCAL BOARD GAS SUPPLY.—The Ilkeston Local Board proposing to borrow £7380 for enlarging and improving their gas-works, the Clerk wrote to the Local Government Board, asking them if they would sanction such loan on the security of the general district rates. At the meeting of the Board last Tuesday, it was reported that a reply had been received to the effect that, as the rateable value of the district was about £25,400, and the existing debt on the town £48,459, the Board had not power to borrow more than an additional £2600 on the security of the rates; but if they desired it, the Local Government Board would sanction a loan of the amount named on a mortgage of the works, or partly on such mortgage and partly on the rates. After a lengthy discussion, it was agreed to apply for sanction to borrow the sum named, on a mortgage of the works, but not at present to take up the whole of the money. It was further agreed that a portion of the proposed enlargements should be postponed for the present.

NORTH OF ENGLAND GAS MANAGERS ASSOCIATION.

The Fifth Half-Yearly General Meeting of this Association was held on Saturday, the 4th inst., at Stockton-on-Tees, under the presidency of Mr. W. Ford. At ten o'clock the Members and Associates assembled at the gas-works. Among those present were Messrs. G. A. Allan, Willington; W. Allan, Stockton; W. Ashmore, Stockton; J. Booth, Southport (late of Middlesbrough); A. Cameron, Glasgow; J. H. Cox, Sunderland; G. Chinnery, Redheugh; R. Clapham, Newcastle; E. Crewdson, Middlesbrough; A. Donaldson, Edinburgh; J. Eadington, Blyth; W. Hardie, Redheugh; J. Hepworth, Carlisle; J. T. Jolliffe, Sunderland; R. Moodie, Gateshead; G. Mossman, West Hartlepool; D. M. Nelson, Glasgow; J. Nicholls, Southbank; R. Prudhoe, Spennymoor; G. Ridley, Newcastle; T. N. Ritson, Carlisle; J. Rollo, Newcastle; G. Rogers, Hexham; J. A. G. Ross, Newcastle; C. Sellers, York; W. W. Smith, Newcastle; T. Trewhitt, West Hartlepool; H. Tobey, Malton; W. V. Thompson, Bishop Auckland; J. Whyte, Seaham; D. Wemyss, South Shields; H. Woodall, Leeds; and Colonel Sadler.

After inspecting the gas and chemical works, the party proceeded to the engine works of Messrs. Blair and Co., and were conducted by Mr. Gray, the Manager of the works, through the several departments. The vast and costly machinery, which is constructed on the latest and most approved principles, was much admired. The works are illuminated by the electric light, and an exhibition of the light was given; but, being in the daytime, was, of course, not so effective as it would have been at night. Near Messrs. Blair's works there were witnessed the Fire Brigade's steam-engine and steam-roller, both in operation, under the direction of Mr. Hall, the Borough Surveyor, and Captain Moore, of the Fire Brigade.

The Company then adjourned to the Corporation Hall, where they were met by the Mayor of Stockton (Alderman J. Richardson, J.P.), Alderman Dodds, M.P., Alderman A. C. Knowles, J.P., Mr. Craggs, and others.

On a stand erected in the hall were numerous specimens of dyes and other articles, the bye-products of tar and ammonia, which had been sent by Colonel Sadler from the laboratory at his works. The exhibition was an interesting one, and was greatly admired.

The Secretary (Mr. W. Hardie) having read the notice calling the meeting, and the minutes of the last meeting having been confirmed, the following new members were unanimously elected:—

Mr. Isaac Carr	Gas-Works,	South Shields.
„ Robert Field	„	Bishop Auckland.
„ Henry Woodall	„	Leeds.

The following gentlemen were elected associates:—

Mr. Edward Crewdson	. Tube Manufacturer, Middlesbrough.
„ E. W. Harding	. . Fuel Works, Sunderland.
„ W. H. Hardy	. . . Tube Manufacturer, Middlesbrough.
„ James Wright	. . . Ironfounder, Stockton-on-Tees.

The President then introduced—

The Mayor, who, on behalf of the ancient town of Stockton, said that he was glad to welcome so important a body as the North of England Gas Managers Association. He had to congratulate his worthy friend, Mr. Ford, on his having been elected to the honourable position of President of the Association. Stockton was not a very large town, but the members would see that its gas-works were equal to those of most towns of a similar character, and as a commercial concern they were a striking example of success and soundness. The works had been in the hands of the Corporation some time, and he considered their acquisition was one of the most fortunate things the Corporation ever did. The average profit on them amounted to between £3000 to £4000 annually, and that sum, although not, as in other towns, applied directly to the reduction of the rates, was handed over to the borough fund, and from that fund was discharged all parliamentary and other extraordinary expenses, should they unfortunately be engaged in a parliamentary contest to protect the interests of the town. The amount to the credit of the fund was now about £12,000. The rates were somewhat relieved by it, and that they were light in comparison with other towns was shown by the fact that last year they amounted to only 2s. 5d. in the pound, 2d. of which was for education, and 1d. for the Free Library; so that practically the rates of the town amounted to only 2s. 2d. in the pound. In common with other towns largely dependant on the iron trade, Stockton had of late years suffered severely, but they were hopeful that a revival in trade was at hand, and in face of this they would be able to hold their own in the path of progress in which they had been for some years. When he came to the town, 25 years ago, there were only 13,000 or 14,000 inhabitants; but now the population was about 35,000, and in the parliamentary borough, which included Norton and South Stockton, there were some 45,000 or 50,000 inhabitants. That was a very rapid stride, he thought, considering the very short time in which it had been accomplished. And now as to the Association. He was glad to see so many gentlemen before him who were connected with gas-making, and to have so beautiful an exhibition of the bye-products of coal tar and ammonia. They were indebted to Colonel Sadler, he believed, for these dyes, &c., for it was to his skill and researches they were due. He recognized the importance of the Association, because he thought the members, by meeting and reading papers, and discussing new ideas and new plans, would greatly benefit themselves and the public. The important trust reposed in gas managers was shown by the fact that in the North some £3,000,000 were invested in gas-works, whilst the amount invested in the whole kingdom was about £60,000,000. In former days, when a manager or other gentleman engaged in some important industry made a discovery, he generally kept it to himself; but now-a-days new ideas were communicated to societies, and this would tend to benefit England as a whole, and make it the foremost nation of the earth. As to the electric light, he thought the gentlemen present, judging from their countenances, had recovered from that scare, and for himself he did not think it was destined to supersede gas, than which for general use nothing better could be found. On behalf of the Corporation and inhabitants of the town, he bade the members of the Association a hearty welcome.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I have to thank you for the honour you have done me in electing me to preside over your meetings during the present session. I must also confess to being somewhat pleased with the thought that you do not expect from me anything in the shape of an elaborate address, seeing that the whole ground upon which I should be likely to enlarge has been so lately and so very ably covered by our friend Mr. Warner (the immediate Past-President of the British Association of Gas Managers), whose exhaustive and eloquent address, delivered before the Newcastle meeting in June last, will doubtless be fresh in your memories.

However, you will no doubt expect some few remarks from me to-day, and I would preface these by congratulating you on the evident success which has attended the meetings of our Association since its formation. Our Association, though not old, has, by the vigorous efforts of many of its members, gained a foothold amongst kindred Associations, which we must hope will be still further strengthened and increased by the individual assistance of each of its members, for all have it in their power to do something towards this end if they only can be persuaded to make the attempt.

It may not, perhaps, be out of place here to remind you how very much we were, and are indebted to the kindness of those friends by whom we were enabled to take upon us the distinguished privilege of providing, on such a liberal scale, so much towards the social and convivial portion of the programme laid out for the June meeting of the British Association of Gas Managers held at Newcastle. I have, moreover, the additional satisfaction of informing you that those esteemed friends have still further increased our indebtedness to them, and added to the stability of our Association, by placing at our disposal the handsome sum of £130, wherewith to establish, in the name of our Association, a fund for the provision of medals, or other prizes, for the best scientific or practical paper or papers that may be read before the half-yearly meetings of our Association. It is earnestly to be hoped that the establishment of this fund will tend to stimulate the efforts of Association members and associates to secure the allotted prizes, for the honour, if not for the intrinsic value of the prizes, and for the advancement of the Association.

There is only one regret which I would venture to express with regard to the Newcastle, or, indeed, provincial meetings of the British Association of Gas Managers, and this, I believe, need only be hinted at to be remedied, and that is the meagre attendance of our Metropolitan friends and members, whose attendance and interest adds so much to the success of the London meetings of the Association. It may doubtless be urged in extenuation that the vast undertakings subject to their control require constant care and attention; but the limited period during which these annual meetings last might surely be spared at that season of the year. Certain it is that if the British Association of Gas Managers is to retain the deservedly high position to which it has attained, it behoves all its members, without distinction or prejudice, to endeavour to be present as well at the provincial meetings as at the London ones. It is a well-known fact that managers of gas-works manufacturing 10 or 20 million cubic feet of gas per annum have to make great sacrifices, and put themselves to much inconvenience in order to attend the London and provincial meetings. This they cheerfully do, and in many cases travel hundreds of miles to be present at them; and, were a little more of this feeling reciprocated by the London members, greater and more beneficial results would accrue to the Association, and its further progress be ensured instead of questioned.

Now that the electric light has settled down into the position to which the majority of gas engineers have relegated it, and to which in a former paper on the subject I maintained it sooner or later would come, this small collection now before you of coal tar dyes and ammonias may prove of additional interest and pleasure. In my own opinion this is the class of products to which we must look in a large degree for the future success of our gas-works from a commercial point of view, for it is daily becoming more evident that the dyes which can be, and are extracted from the tar products are rapidly usurping the place of the great majority of those, so to speak, natural dyes which have had to be imported into this country; while the products of ammonia are quickly displacing more expensive substitutes in manures, and in other industries. No doubt the introduction of the electric light has been of very considerable advantage in many ways, and perhaps in none more so than the stimulating effect it has produced on gas industry, whereby every possible advantage is taken of the properties of gas and its bye-products for the better production of a purer and cheaper light; and these ends will doubtless be still further advanced and assisted by the better and more technical, as well as practical education in all the branches of our profession in which the rising generation are being trained.

I need not remind you of the severe depression under which the iron industries of Cleveland, as of other districts, are suffering; yet I venture to hope that the change for the better which seems to be setting in will not be long ere it be confirmed and consolidated, and gradually but effectually remove the cloud which has been hanging over us for so long, and with such disastrous results. In the general revival, Cleveland, with its natural resources and the innate energy and perseverance of its manufacturers, will not be slow to take advantage of the times, and much may be expected from it.

I had hoped to have had the pleasure of showing you over the magnificent steel works recently erected at Eston, on the latest and most improved systems of working, by Messrs. Bolckow, Vaughan, and Co.; but I very much regret that, owing to the fact that some new and important researches are in course of manipulation, the Directors have been unavoidably constrained to withhold permission from the Association at present viewing the works. I am the more sorry for this, knowing that the mechanical appliances used for the manipulation of the raw materials and the finished articles are of so ingenious and interesting a kind as would, on inspection, prove a source of very much pleasure and profit to members of such a society as ours, and this alone accounts for the want of any papers more immediately associated with our own manufactures. Nevertheless, I hope those of you who have come so great a distance to be disappointed in one of the main features of this meeting—viz., the steel works inspection, will not go home altogether disappointed with their visit to the ancient Borough of Stockton, which traces its Mayors back so far in a direct line as the year of our Lord 1495; and those of you who have had the pleasure of visiting Messrs. Blair and Co.'s marine engine works this morning will readily admit that they are a sight in themselves, being acknowledged as one of the finest establishments of the kind in the North of England.

Mr. James Wright, M. Inst. M.E. (Stockton-on-Tees), then read a paper entitled

NOTES ON CLEVELAND AND ADJOINING DISTRICT, WITH A FEW FACTS AND OPINIONS OF INTEREST TO GAS ENGINEERS.

I will state at the outset that it is not my intention to touch upon the recent deplorable commercial history of this district, under which it suffers in common with other manufacturing centres of the country; neither will it be expected, or be necessary, that I should describe such (to you) comparatively unimportant items as boundaries, soil, climate, physical features, &c., except to say with regard to the latter, that everybody has heard of the famous hills of Cleveland, and the wealth annually drawn from them. It must, therefore, be upon them, and the various manufactures sustained by the enormous quantities of ironstone and coal derived from the neighbourhood, that the main interest of any remarks on the subject chosen will turn.

Taking this, then, as my starting point, I ask you first to note the fact that Cleveland ironstone has been stated to underlie an area of 420 square miles, and it is supposed that the main seam alone will yield 20,000 tons per acre throughout this area. From these figures, it is easily calculated that at the time this estimate was made there were 5376 millions of tons of ore underlying Cleveland. The consumption, or rather the amount of ore raised during the year 1877 was 6,284,545 tons, and in the year 1878 it was 5,605,639 tons, showing a decrease of 678,906 tons of ore raised from the mines in that year. Putting, therefore, the consumption of the ore at between 5½ and 6 millions of tons per annum, it will not be difficult for any one so disposed to calculate the probable number of years or genera-

tions the mines will supply the Cleveland and South Durham iron trade. I prefer not to prophesy upon the subject, for I well remember, as you will also, that a few years ago certain prognostications were made at Newcastle as to the duration of our coal supplies, which, although they have had the effect of getting us better information as to the extent of those supplies, have certainly not been borne out to the letter by recently published statistics as to the annual output. For, instead of an annually increasing quantity of so many millions of tons raised, or of so much per cent. (compound interest), we find an actual decrease—comparing 1876, the highest year, with last year—of 1½ million tons. I have referred to this as an example to deter, or at any rate to warn gentlemen that way inclined, from indulging in prophecies which may unduly raise hopes or fears.

Trade so ebbs and flows that the date of exhaustion of Cleveland mines and Durham coals cannot be fixed with accuracy to a generation or two. All we know with certainty is, that there is no such other extensive supply of either mineral in the country, and I hope to adduce figures which will prove to you, with regard to iron, that there is none so cheap, and none more suitable in the United Kingdom for constructions connected with gas-works. It is true that our minerals are allied with impurities; but pure iron is the same all the world over, and, having this as a base, the only problem left is how to get rid of the impurities. This problem is, you are aware, in a fair way of being solved. To show this, I have only to point to the now world-renowned recent improvements in the manufacture of Bessemer steel, which have, so to speak, found a birthplace in Cleveland. There are so many eminent names and firms involved in this work, that I consider it would be invidious, and an unnecessary trespass upon your time, to particularize them.

I will now proceed, as concisely as possible, to give you a few facts relative to the general trade of the district. The raising of the enormous quantities of ore I have mentioned finds employment for about 10,000 men. In 1866 the make of pig iron in Cleveland and the adjoining district of Durham, of which Stockton may be taken as being the centre, was about 1 million tons. In 1876 this make had exactly doubled, being then approximately 2 million tons, which was very nearly the same make as in the whole of the United States for that year. In 1877 there was about the same make of iron in this district, and in 1878 the total output was 2,018,765 tons, produced as follows:—In Durham there are 75 blast furnaces, 33 of which were working, and producing 660,323 tons towards the quantity named, being an average of 385 tons per week per furnace. In the Cleveland district proper, with 67 furnaces in blast, out of a total of 90 built, 1,358,442 tons were produced, giving an average weekly output of 390 tons per furnace. The whole of this iron was sold at an average price of £2 2s. 3d. per ton, whilst in Staffordshire their average selling price during the same time was £3 18s. 9d. per ton. (Authority, Mr. Hunt's "Mineral Statistics.") In the united district of Cleveland and Durham there are 165 blast furnaces, and in order to give you an idea of the capital employed in the production of pig iron alone, I may say that the cost of each of these furnaces would probably range between £15,000 and £20,000, according to the time at which they were built. Taking £17,500 as the average value of each, this gives us a total of £2,887,500 invested in blast furnace plant alone. Whatever may be our future with regard to wrought iron and steel, there is no doubt but that pig iron must long remain our great staple production.

The quantities of manufactured wrought iron and steel turned out by our rolling mills and forges may be summarized as follows:—

Date.	Iron Rails.	Plates and Bars.	Steel Rails.
1876 ..	108,000 tons. ..	314,000 tons. ..	*Nil.*
1877 ..	36,000 ,, ..	349,000 ,, ..	No return.
1878 ..	21,000 ,, ..	400,000 ,, ..	75,000 tons.

The figures adduced show an extraordinary vitality in north country trade, on account of which I will ask you to allow me to dwell upon them for one moment, to point out that in 1876 our total products of finished iron were 422,000 tons, which included 108,000 tons of iron rails; but last year, although our make of iron rails had fallen to 21,000 tons only, there was such an increase shown by the addition to our manufactures of steel rails, and by the largely increased production of plates and bars, that our total manufactures actually amounted to 496,000 tons, exceeding the other year by 74,000 tons. It is this enormous vitality, notwithstanding the large financial disasters which have unfortunately taken place, which gives us all heart and hope as to the future of this district.

The time at my disposal will not allow me minutely to describe all the other manufactures which flourish side by side with the great parent trades just referred to, but I must not omit to mention in your presence the factories in which you are specially interested; and first I would name the pipe foundries on Tees side. Commencing at home, we have here in Stockton the firm of Messrs. T. Allan and Sons, who have courteously informed me that they can produce with present appliances over 200 tons per week, and will be very pleased to increase this heavy make as soon as required. I have applied to Messrs. Cochrane, Grove, and Co., and to Messrs. Hopkins and Gilkes, for figures as to the quantities they could produce; but inasmuch as they had not sent their statistics to me at the time of writing this paper, I can only assume their combined productions in pipes to amount to at least 600 tons per week; and if I include in the calculation Mr. Bower's works at Hartlepool, it gives approximately 1000 tons per week as the make of cast-iron pipes.

In addition to the firms mentioned, we have the wrought tube works, at Middlesbrough, of Messrs. Crewdson and Hardy, who have turned out over 1½ million feet of gas, steam, and hydraulic tubes per annum, over and above the bends, crosses, tees, and fittings in the usual list. I understand that one of the partners in this firm was for a long period manager for one of the leading Staffordshire houses in this trade; so there is a guarantee that their manufactures are at least equal to those produced there. I must by no means omit to mention the large works in this town of Messrs. Ashmore and While, which are adapted for the construction of all kinds of gas plant, from the smallest governor vessels, not only to the largest gasholders now known to be at work, but even to the largest sizes we hear of being planned, and the air is thick with rumours as to some very gigantic and bold designs which are shortly to be produced. These works, since their establishment nine years ago, have produced gas plant to the value of over a quarter of a million sterling.

Besides all these, we have in Stockton here one of the, if not the leading marine engine shop on the north-east coast. I mean that of Messrs. G. G. Blair and Co. Then there are the engineering works of Messrs. Head, Wrightson, and Co. The Stockton Forge Company, as well as the brass and iron foundries of Brown Brothers; Mainwaring, Wilson, and Co.; T. J. Thomson and Co.; Crossthwaite and Co., and one of the largest yet known in the North, now in course of construction by Messrs. Smith and Stoker.

Middlesbrough possesses much the same, or greater facilities, which time will not allow me to enumerate in detail, for executing all kinds of ironwork. In addition to which there are the outlying towns of Darlington and the Hartlepools, Norton, Carlton, Eston, Port Clarence, &c., and the whole estuary of the Tees, which from Stockton to the sea is rapidly becoming one continued series of workshops. On both sides of the river at Stockton there are large shipyards engaged in building iron and steel ships. The total tonnage of iron ships launched last year upon the Tees was 12,700 tons.

This brings me to the question of facilities for the cheap transit of goods to both inland and foreign markets, which either are, or can easily and well in time be made to be quite unsurpassed. We have the shipping ports of the Hartlepools, Middlesbrough, Stockton, and Whitby. From the port of Middlesbrough alone, during last year, which I would have you bear in mind was a year of great depression, there were shipped 422,480 tons of pig iron to English ports, 337,559 tons to foreign ports; 167,233 tons of steel and finished iron; 47,966 tons of coal to English ports, 31,309 tons to foreign ports; and 31,500 tons of coke; making a total of 1,038,048 tons gross shipment from one port alone. For inland communication we have the questionable advantage of having only one railway company—the North-Eastern—by which to forward our goods to consumers; and as they have a complete monopoly of all our inland traffic, the battle of the rates is always proceeding between them and the traders of the district, and to them I will for the present leave it.

You will gather from the foregoing statements that any requirements of gas engineers and managers in the shape of apparatus in iron for their products can be supplied here; but, whilst the great iron interests have thus been preparing to supply your wants, the chemists of the district have not been behind in perceiving that you had some valuable commodities to sell or send into our towns in exchange for ironwork. I need only mention the name of Dr. Sadler, and to say that at his Middlesbrough works alone there is consumed 2,500,000 gallons of tar, and 3,000,000 gallons of ammoniacal liquor per annum. These large quantities are collected over a considerable area, including Yorkshire and Durham, by rail, and along the east coast from Berwick to London by sea. In addition to his works, there are those of Messrs. Jones of Middlesbrough, Ness of Darlington, and others of which I have been unable to gather particulars.

Having shown you that the facilities are here both for enabling us to buy from and sell to you, I will now endeavour to show the results all these facilities have upon our markets, by comparing the prices paid for the products of this district with those in Staffordshire during the last 3½ years. My figures are taken from the *Iron and Coal Trades Review*, and although it is possible iron may have been bought in either district at prices slightly above or below the figures given at the times quoted, still they may be considered as being in the main correct, or at any rate sufficiently near for the purposes of comparison. I have obtained them in order to be able to place before, and prove clearly to you the claims of Cleveland for a larger share of support and patronage at the hands of gas companies, their managers, and engineers—gas, mechanical, and civil—as much in their own interests as in those of the Cleveland trade.

Table No. 1.—Pig Iron.

Date.	Cleveland No. 3 Foundry.	Whitwell's Thornaby Cleveland No. 3.	Staffordshire Mine No. 4.	Difference between Staffordshire and Cleveland.	Difference between Whitwell's and Staffordshire.
	Per Ton.	Per Ton.	Per Ton.	Per Cent.	Per Cent.
January, 1877	£2 6 0	£3 0 0	£3 10 0	34·2	14·3
,, 1878	2 1 0	2 14 0	3 5 0	36·8	17·0
,, 1879	1 14 6	2 10 0	3 5 0	46·9	23·0
*June, 1879	1 13 0	2 10 0	2 10 0	34·0	—

* This was the lowest point reached according to the public prints.

This, therefore, shows that Cleveland pig iron, No. 3 foundry, during the last 3½ years could be purchased at a difference ranging between 34 and 46·9 per cent. cheaper than Staffordshire No. 4 mine; and that Whitwell's Thornaby No. 3 could have been purchased at a difference ranging sometimes as high as 23 per cent. in favour of the iron produced in this district.

Table No. 2.—Plates.

Date.	Cleveland Ordinary for Ships & Girders.	Staffordshire Ordinary for Ships and Girders.	Difference per Cent.	Cleveland Boiler.	Staffordshire Boiler.	Difference per Cent.
	Per Ton.	Per Ton.		Per Ton.	Per Ton.	
January, 1877	£7 7 6	£9 0 0	18·0	£8 5 0	£9 10 0	13·1
,, 1878	6 5 0	8 0 0	21·8	7 5 0	8 10 0	14·7
,, 1879	5 10 0	7 15 0	29 0	6 10 0	8 0 0	18·7
June, 1879	5 0 0	7 0 0	28·6	6 0 0	7 5 0	17·2

My figures in Table No. 2 show that Cleveland ship, girder, and roof plates could be purchased at 24½ per cent. less cost than Staffordshire, and Cleveland boiler plates averaged 15·9 per cent. cheaper than those from the English rival district.

Table No. 3.—Sheets.

Date.	Price of Cleveland Sheets.	Price of Staffordshire Sheets.	Difference per Cent.
	£ s. d.	£ s. d.	
January, 1877	8 10 0 per ton.	9 0 0 per ton.	5·5
,, 1878	7 10 0 ,,	7 15 0 ,,	3·2
,, 1879	7 0 0 ,,	7 10 0 ,,	6·6
June, 1879	7 0 0 ,,	7 0 0 ,,	None.

My figures as to sheets only show a difference during 3½ years of 5·1 per cent. in favour of purchasing in Cleveland, and you will notice that whilst the price of our home-made sheets has not altered since Christmas last, that of our competitor has been brought to the same level, so that in June last there was no difference.

Table No. 4.—Angle and Bulb Iron.

Date.	Cleveland.	Whitwell's Crown Quality.	Staffordshire.	Difference per Cent.
	£ s. d.	£ s. d.	£ s. d.	
January, 1877	6 17 6 per ton.	7 0 0 per ton.	9 0 0 per ton.	23·6
,, 1878	6 0 0 ,,	6 5 0 ,,	6 15 0 ,,	11·1
,, 1879	5 5 0 ,,	6 0 0 ,,	6 10 0 ,,	19·2
June, 1879	5 0 0 ,,	5 15 0 ,,	6 5 0 ,,	20·0

Table No. 4, as to prices of angle and bulb iron, shows an average difference between Cleveland and Staffordshire of nearly 18¼ per cent. in favour of the former market for this class of ironwork.

Table No. 5.—Round, Flat, and Square Iron (Ordinary Sections).

Date.	Cleveland.	Whitwell's Crown Quality.	Staffordshire.	Difference per Cent.
	£ s. d.	£ s. d.	£ s. d.	
January, 1877	6 7 6 per ton.	6 10 0 per ton.	7 0 0 per ton.	8·9
,, 1878	5 12 6 ,,	6 0 0 ,,	6 0 0 ,,	6·5
,, 1879	5 2 6 ,,	5 10 0 ,,	6 0 0 ,,	14·5
June, 1879	4 17 6 ,,	5 10 0 ,,	5 15 0 ,,	15·2

The average saving by purchasing round, flat, and square iron, of the class given in the above table (No. 5), in this district, during the last 3½ years, is shown to be 11¼ per cent.

Now, I have no doubt at all that the facts as shown by the preceding figures have been known by most, if not all, of the gentlemen I have the honour of addressing; but I have brought them forward on this occasion in the hope that through this Association they may reach the members of others, and thus open the eyes (so to speak) of engineers in the South to advantages they cannot enjoy, if they continue to use in their specifications a clause so meaningless as this: "The iron used in the construction of the work shall be of Staffordshire quality." The manufacturing engineer of Cleveland no sooner sees this than he closes the specification, and gives up the idea of submitting a tender, and the result is that the gas company or other users of the iron do not get the advantage they might from the cheap markets of the country. Can any one tell what Staffordshire quality is? There is no standard for its production, and the fact is that each maker in Staffordshire gives you a quality and standard of his own, which I know, from lengthened experience, is not superior, as a general rule, to Cleveland iron. It cannot, of course, be denied that there are one or two leading Staffordshire firms, as there are also Cleveland and Stockton firms, who produce iron of first-class quality, and get paid for it; but it is trading too much on our credulity to expect us, who send so much pig iron into that county, to believe that all the wrought iron that is made there is produced from Staffordshire mine iron. As to the ordinary, every-day, merchant, common iron of commerce in that district, I have had ample opportunities of forming an opinion, which is, that it is in no degree superior to that produced and sold here. Engineers ought to be acquainted with the fact that there are thousands of tons of plate and bar iron sent annually from this district to Staffordshire, so that even the specification gives no guarantee that they get Staffordshire iron.

Among the many anxieties gas engineers labour under, that must naturally be a great one which relates to the quality of materials used in the apparatus they employ, and it is very far from my desire, as a constructive engineer, to attempt in any degree to depreciate the absolute necessity for keeping up the standard of quality; but this will not be done by the use of such obsolete and meaningless clauses and phrases as the one I have quoted. It will be better for all of us to know exactly where we stand, and all the maker of the bridge, girder, roof, or gasholder wants to know is the number of tons per square inch the designer wishes the iron used in the construction to carry. Give us this, and we can produce it as well in Cleveland as elsewhere.

With a view to satisfy this meeting that good class iron is produced in the ordinary way here, and that our low prices do not necessarily involve low quality, I have prepared two tables showing the results of recent tests the iron has passed through. The first (A) gives a record of tests made upon iron purchased for various contracts by Messrs. Ashmore and While during the last two years, and where any special quality was stipulated it is given in the column headed "Specified Test."

TABLE A.

Date.	Maker's Name.	Quality.	Description of Iron Tested.	Dimensions of Sample Tested.	Ultimate Stress per Square Inch Original Area.	Average Ultimate Stress.	Specified Tests.	Name of Testing Firm.
				Inches.	Tons. Cwt.	Tons. Cwt.	Tons.	
March, 1879	Stockton Malleable Iron Co.	Ordinary	T 6 × 3½ × ½	1·00 × 0·53	27 7	24 6½	—	Stockton Forge Company.
,,	,, ,,	,,	,,	1·30 × 0·53	21 8			,, ,,
,,	,, ,,	,,	,,	1·15 × 0·50	23 1			,, ,,
,,	,, ,,	,,	,,	1·10 × 6·50	25 9			,, ,,
July, 1879	Jackson, Gill, & Co.	Best	1¼ diameter	1·01 × 0·50	25 0	*24 10½	—	,, ,,
,,	,,	,,	,,	1·01 × 0·51	24 1			,, ,,
May, 1878	W. Whitwell & Co.	W. W. Crown	T 5 × 2½ × ½	1·25 × 0·525	22 10	22 10	—	,, ,,
,,	Johnson & Reay	Common	Plate	1·01 × 0·565	21 18	21 18	—	,, ,,
October, 1878	W. Whitwell & Co.	W. W. Crown	T 4 × 2 × ⅝	Web 1·21 × 0·36	24 2	23 16	21	D. Kirkaldy.
,,	,, ,,	,,	,,	Flange 1·3 × 0·36	23 11			,,
,,	,, ,,	W. W. best	1 13-16ths dia.	1·80	26 7½	26 7½	21	,,
,,	,, ,,	W. W. Crown	A I 4 × 4 × ½	2·04 × 0·50	21 18	21 18	21	,,
,,	,, ,,	,,	,,	2·00 × 0·50	21 18			,,
,,	,, ,,	,,	A I 2½ × 2½ × ¼	1·58 × 0·25	23 4	23 10	21	,,
,,	,, ,,	,,	T 3 × 4 × ¼	3·00 × 0·42	24 0			,,
,,	,, ,,	,,	T 2½ × 2½ × ¼	2·30 × 0·39	23 6			,,
,,	,, ,,	Crown	A I 4 × 4 × ¼	2·00 × 0·47	22 16	22 16	21	,,
,,	Stockton Malleable Iron Co.	,,	Flat 12 × ⅝	2·00 × 0·62	23 14	23 14	21	,,
,,	W. Whitwell & Co.	Best	1 13-16ths dia.	1·80 × 0·00	23 2	22 9	21	,,
,,	,, ,,	,,	Flat 3 × ⅜	3·06 × 0·86	21 16			,,

* These two bars were tested in the presence of a gentleman now in the room.

The following table (B) is self-explanatory, and gives the results of a few tests of Cleveland plate and Whitwell's iron:—

TABLE B.

Date.	Maker's Name.	Quality.	Description of Iron Tested.	Dimensions of Sample Tested.	Ultimate Stress per Square Inch Original Area.	Average Ultimate Stress.	Specified Test.	Name of Testing Firm.
					Tons. Cwt.	Tons. Cwt.	Tons.	
March, 1879	Bowesfield Iron Company	Special	Plate	0·77 × 0·31	24 2	22 16	21	Head, Wrightson, & Co.
,,	,, ,,	,,	,,	0·77 × 0·31	25 3			,, ,,
,,	,, ,,	,,	,,	0·76 × 0·30	20 17			,, ,,
,,	,, ,,	,,	,,	0·75 × 0·30	21 2			,, ,,
August, 1879	,, ,,	,,	,,	1·75 × 0·30	24 8	24 13	22	Stockton Forge Company.
,,	,, ,,	,,	,,	1·75 × 0·355	25 2			,, ,,
,,	,, ,,	,,	,,	1·75 × 0·36	24 15			,, ,,
,,	,, ,,	,,	,,	1·75 × 0·36	24 9			,, ,,
	W. Whitwell & Co.	W. W. Crown	Angle Iron	1·00 × 0·46	25 16	26 12	None.	Head, Wrightson, & Co.
	,, ,,	,,	,,	1·00 × 0·46	27 8			,, ,,
	,, ,,	,,	,,	—	24 14	24 13	,,	D. Kirkaldy.
	,, ,,	,,	,,	—	24 12			,,
	,, ,,	Best rivet iron.	T 4 × 2½ × ⅝ 19-32nds dia.	19-32nds dia.	27 4	27 4	,,	,,

The tests recorded in the above tables are sufficient to satisfy any reasonable person as to the ability of Cleveland makers to turn out iron of a high quality. I have not gone out of my way in the least to hunt up statistics as to the highest tensile strain to be obtained out of Cleveland iron, but have simply quoted from facts and materials which were ready to my hand. I now leave the question of Cleveland iron for the present, but will just remark that the engineer who will not be satisfied with these tests for iron in ordinary constructions, and at the prices paid here, will be badly in want of steel, and before bringing this long and, I fear, uninteresting paper to an end, I will shortly revert to that metal, and what is being done with regard to it.

Of course, the steel-works *par excellence* of Cleveland are those of Messrs. Bolckow, Vaughan, and Co., at Eston, which are said to comprise all the most recent improvements known to the world, and possibly a few also not known. At the beginning of this year it was anticipated that they would alone produce 2000 tons of steel rails per week. I am sorry I am not in a position to say at present how far they could meet the possible requirements of the gas world by rolling steel sheets, plates, angles, and tee iron.

The next works in magnitude from which engineers in this neighbourhood can cheaply obtain supplies, are those of the Weardale Company, near Spennymoor. I have been particularly anxious to ascertain as to what sections of steel angles, tees, round and square iron could be procured for use in gasholders, and my request for information, addressed to the Weardale Company, met with the following courteous response from their Mr. Du Pré:—

"We beg to state that our steel is made by the Bessemer process, and we make bars of from 3-16ths to 8-inch diameter, 3-16ths to 5-in. square, angles, tees, &c., of sections from 1½ to 12 united inches; hoops, strips, nail rods, plates and sheets. Our mills are equal to an output of about 25,000 tons a year of iron and steel. Our pig iron is made from the spathic ores of Weardale, which are remarkable for their almost absolute freedom from phosphorus."

Another steel-works is now in course of erection at Middlesbrough by Mr. J. Butler, which is expected to produce when in full operation 40 tons of steel castings per day by the Siemens process. The Darlington Iron Company also, it is no secret, are adapting their works, or a portion of them, to the manufacture of steel; and Mr. J. Southerst, of the Cleveland Steel-Works, Guisborough, is building new works, which are either now, or will soon be in operation. As a result of all this, the Stockton gasholder firm will very shortly be able to specify steel in the construction of their gasholders.

The following table gives the results of experiments to ascertain the tensile strength of Weardale Bessemer steel:—

Date.	Description of Steel Tested.	Dimensions of Sample.	Ultimate Stress per Square Inch.	Name of Testing Firm.
March, 1878	Plate lengthway	24 × 24 × ⅝ in.	30·7 tons.	D. Kirkaldy.
,,	,,	24 × 24 × ⅝ ,,	31·2 ,,	,,
,,	Plate crossway	24 × 24 × ⅝ ,,	31·7 ,,	,,
,,	,,	24 × 24 × ⅝ ,,	31·7 ,,	,,
,,	Bar	1 inch diam.	31·2 ,,	,,
,,	,,	1¼ inch ,,	31·1 ,,	,,
,,	Angle iron	1¾ × 1¾ × ¼ in.	31·0 ,,	,,
,,	,,	1¾ × 1¾ × ¼ ,,	31·0 ,,	,,

These results are remarkably uniform, so much so as to make it certain that steel of a highly reliable character may be obtained from that firm.

I have surely now mentioned enough to prove to gentlemen here present that they are in the centre of the finest, cheapest, and I may say the leading manufacturing district in the United Kingdom for supplying their requirements. Cleveland can appeal with confidence to gas managers, and any intelligent body of gentlemen visiting her towns, to give her products a fair trial, alongside those of her older rivals. If she can give them equal quality combined with the saving in first cost of raw materials, ranging, as I have shown, from 5 to 45 per cent., it becomes a positive duty, in the interests of their employers, to try and obtain for them the benefits of such cheap production, by keeping from specifications all clauses which are of a restrictive or unfair character. This account by no means does justice to the capabilities of the district, as it was impossible to attempt it in the time at my disposal; still, if anything I have said awakes an interest in it in the minds of the members of this Association, and through them reaches the other members of the gas engineering profession, the time occupied in compiling this imperfect summary will not have been spent in vain.

Mr. Ross (Newcastle) thought an important omission had been made by Mr. Wright in not referring to the waste products of iron manufacture in the immense amount of slag produced, which, instead of being a source of revenue, cost frequently large sums of money for its removal, and occupied considerable spaces of land. Now, they knew that the bye-products of gas-making, which, in the first instance, were ignored, had become of great importance in cheapening gas and producing profits. So, in blast fur-

naces, slag, of which from 8 to 10 million tons were produced annually in this country, contained gold, silver, and other precious metals. In addition to this, slag was being manufactured into glass bottles and toughened-glass sleepers for railways; it also made excellent cement, and was being used for making building bricks. There was also in the immediate neighbourhood of Stockton a manufactory for the production of "silicate cotton" or "slag wool," greatly resembling cotton or wool, which was one of the best-known non-conductors of heat, and, being incombustible, was extensively used for covering steam boilers and pipes. This was of great economic importance, the covering of a long steam-pipe having in one case resulted in a saving equal to dispensing with one boiler out of eight, or 12½ per cent.

Mr. HEPWORTH (Carlisle) said he had listened with much pleasure to Mr. Wright's paper, and had been especially interested in the efforts which had been made from time to time to utilize the slag produced in the manufacture of iron, as adverted to by Mr. Ross. Some of the best macadamized roads in the country were made from the dross of iron-works, and in passing over many of the streets to the hall that day he found they were paved by the *scoriæ* bricks moulded from this dross. It appeared that not only railway sleepers were now being made from it, but that in this district even "silicated cotton" or "wool" was also produced, and used for non-conducting purposes. The paper read by Mr. Wright opened up a field of great interest, and if the utilization of waste products in ironwork should go on to receive further development, the results bade fair to vie with those obtained from the residuals of gas-works, of which they had such magnificent samples in the room.

On the motion of the PRESIDENT, a hearty vote of thanks was accorded to Mr. Wright for his paper.

The following paper by Mr. S. RUTTER, of Brampton, was read by Mr. Hepworth:—

A WINDMILL PUMP.

In submitting to your notice the model of a windmill pump, some may think I am bringing a matter of very trifling importance to the front. It may be so, but I hope you will consider it has some merit by its simplicity, and that for small works without an engine it will be found of use.

I ought to state first that when I took charge of my present works they had a scrubber which was just a cylinder made of boiler-plates—5 feet internal diameter and 12 feet high—placed on a stone bed, but without inlet and outlet pipes, as it had never been used. I had a tank made of the same diameter as the scrubber, to hold 400 gallons of water. I put a distributor in at the top, and another in the middle, with a small square cistern at the side of the tank, supplied with town's water, which I regulated to the distributor. The tank on top of the scrubber is supplied with ammoniacal liquor, which is carried down to the distributor in the middle of the scrubber. By admitting one part fresh water at top, and five parts of ammoniacal liquor in the middle, the liquor when it leaves the scrubber is as strong as when it enters. Once in 24 hours the scrubber is flushed well with fresh water and ammoniacal liquor for, say, ten minutes. It bears more fresh water in winter. The scrubber is filled with deal boards, 6 inches wide and ½-inch thick, placed horizontally on edge, with a space between, each being kept apart by a lath 6 in. by 1 in. by ¼ in. Each layer is placed at right angles with those above and below. The boards are not quite horizontal, but at an angle of 65°. In this way the surface is kept better wetted.

In order to keep the tank supplied with liquor, I erected a windmill, and connected it to the end of the handle of the pump with a short crank attached to a small bevel wheel, a larger bevel wheel being fixed to the upright shaft. It is surprising what little wind is required to drive the pump. If there is a dead calm for 20 hours out of the 24, the four hours wind will keep the scrubber well supplied. It does not need any attention, and in the strongest gale works as well as when there is only a slight breeze, only going faster, but without vibration.

The cones or fans are pointed, so that from whatever quarter the wind is blowing, the mill works. As the points divide the air, there is, comparatively speaking, no back pressure. The cones are 2 ft. or 2 ft. 6 in. in diameter, and from outside one cone to outside the cone on the opposite side is 11 ft. 6 in. It is quite impossible for the wind ever to send them the wrong way round. The suction-pipe is 1½-inch two-thirds down the distance to the tank underground. I use for a valve two diminishing sockets screwed together, with a leather washer and india-rubber fall.

One of these pumps is fitted up by the side of a gasholder column to supply water to a leaky tank, and thereby the Company saves some £15 or £20 a year for water.

Mr. HEPWORTH, before resuming his seat, said he thought the paper which he had just read, and the model which accompanied it, formed an interesting communication, and was of such practical character as the Association would always encourage. He was glad that, when Mr. Rutter found he could not attend, he took the trouble to send his paper and model. The pump was designed for a certain purpose, and effectually attained the object desired. It afforded an illustration of the simple way in which one of the forces of nature might sometimes be utilized for common purposes. Mr. Rutter had no steam, and manual labour, besides being costly, was not to be relied upon; he therefore made the wind do his pumping, and saved £20 per annum in water—an item which, though not large, in his case was probably of some importance.

A vote of thanks was awarded to Mr. Rutter for his paper and model.

SLIDE-VALVE PUMPS FOR TAR AND LIQUOR.

The SECRETARY read the following communication from Mr. R. J. Worth:—Every one is aware that there is a difficulty in pumping tar with ordinary pumps, owing to the clacks sticking fast; but this difficulty is entirely obviated in my pump by doing away with clacks altogether, and substituting for them a slide-valve moved directly by the engine itself, which does not at all depend for its motion, as clacks do, on the liquor being pumped. The effect of this should be absolute certainty in the action of the pump; and that this end is nearly attained in practice may be proved by the fact that a pump on this construction has worked for four years without requiring the cover to be taken off. Good as this result is, I believe it can be improved upon, and I am now engaged on a new form of pump, which, while retaining its essential feature, the slide-valve, does away with the crank-shaft, connecting-rod, and eccentrics, and reduces the machinery to a simple lever, which actuates both the valves. A model of these improvements I hope to have the pleasure of exhibiting at some future meeting.

Several gentlemen spoke of the efficacy of Mr. Worth's pumps, amongst others, Colonel SADLER, who said he had had one at work for seven years, during which period it had not required any attention.

The SECRETARY also read a paper by Alderman Wilson on a new system of blowing-engine, specially adapted for malting purposes, and designed to enable malting to be carried on all the year round, instead of only three months as at present. It was, however, applicable, as he explained, to facilitate the exhausting of gas.

THE CONSTRUCTION OF GLOBES AND SHADES FOR GAS-BURNERS.

Mr. C. SELLERS (York) said: I intended to lay this question before the meeting in the form of a paper, but have not had time to do so. I therefore trust that any want of clearness in my remarks will be excused. Up to quite recently the opening at the bottom of a globe was about 2 inches, but recent investigations have shown that this diameter is insufficient, and has evidently been dictated more by a desire to produce a globe that should be ornamental than by any intelligent knowledge of the conditions necessary to produce a proper combustion of gas, so as to obtain the most light. The result of these investigations has been to direct attention to this matter, but without, as yet, coming to any definite conclusion. In consequence, there is no uniform standard as to the width of openings, and manufacturers of globes and glass-holders, or galleries, are in a state of uncertainty. I am quite aware that this Association cannot enforce any rule either upon the public or upon the trade, but I am decidedly inclined to think that an expression of opinion by the Association would have considerable weight, and would very much tend to establish such a rule as to the width of the opening at the bottom of the globes as would produce the best results; in other words, obtain the most light from the gas used. I am quite aware also that it is a difficult thing to alter a custom such as I allude to; but I maintain that it is the duty of such Associations as ours to use every means in our power, now that gas has to compete with the electric light, to give it every possible advantage, and not allow its light to be smothered by improperly-constructed globes. I know the public will be slow to move, except in cases where new fittings are wanted, and that manufacturers will not care to take any steps unless they have orders, simply because it is not their interest to do so. But I hold that it is our interest to stir in this matter, and therefore it is that I would submit a recommendation to this meeting, asking it to pledge itself to carry out the necessary reform. The present opening of an ordinary globe is, as I have already said, about 2 inches. This has generally been condemned as insufficient, principally because a narrow opening creates a too rapid rush of air into the glass. This disturbs the flame, and does not feed it sufficiently with oxygen; therefore it prevents perfect combustion, and, as a consequence, the ceilings of rooms become blackened, and a certain amount of light is necessarily lost. The loss of light by the use of globes varies from about 40 per cent. in the case of a globe ground all over, to about 10 per cent. in globes that are clear; and this, too, when the globes are quite clean. What, then, must be the loss of light when they are discoloured and dirty, which I am afraid is not an unusual condition? This is another reason why globes should at the bottom be as little obstructive as possible to the light, for it is from the bottom that the most light is required. To show that a wider opening in globes is in harmony with all modern improvements in the use of gas, and that the best authorities upon the subject agree, we have only to look at the globes adopted by Brönner, Sugg, Bray, and others, all of which have openings of something like 3 inches. Mr. Roberts, of the Sheffield Gas Company, has, I believe, adopted a 3-inch opening, and I am doing all I can to carry out the same reform.

Mr. HEPWORTH said this was one of the small subjects which were of considerable importance in the distribution of gas. He agreed with Mr. Sellers that it was quite time that globes should be adapted to the proper combustion of gas. They all knew the importance of selecting suitable burners, and, perhaps, next to that in importance was the selection of globes, which might admit or exclude the oxygen requisite for combustion. They were much indebted to Mr. Sugg for having given so much attention to this subject, and if, as had been proposed, a standard could be suggested to the makers of globes, it would doubtless be found of considerable advantage.

Mr. H. WOODALL (Leeds) said he was glad Mr. Sellers had broken through the usual rule of introducing a subject by writing a paper. It was true that greater care could be given to a question in the form of a paper, but there was so much labour in its preparation that many gas managers could not afford the requisite time. He quite agreed with Mr. Sellers that there was great need for improvement in the make of globes and shades for gas-burning, some of which absorbed a considerable quantity of light, and so brought discredit on the gas itself.

Mr. NELSON (Glasgow) agreed with the preceding speakers, but thought that a uniform opening at the bottom of globes would scarcely answer the purpose, as different gases required a different quantity of air to secure perfect combustion. He, therefore, thought globes should be made to suit the different candle power of gases.

The PRESIDENT said the members were very much indebted to Mr. Sellers for introducing so useful a subject, and he felt sure that some good would result from the discussion.

Mr. NELSON then, in a few remarks, brought before the Association the expediency of approaching the British Association for the Advancement of Science with a request for recognition. Electricity as an illuminator had been taken within the scope of its discussions, and he submitted that, either in the Chemical or Engineering Section, gas-making was entitled to a place.

It was agreed that the subject was an important one, and it was arranged that it should be taken into consideration at another time.

On the motion of the PRESIDENT, it was unanimously resolved to make up to £150 the £134 spoken of in his address, and to invest that sum in the stock of a local gas company; Messrs. Cox, Trewhitt, and Hardie to be the trustees, and to have power to select the Company in which the investment should be made.

The PRESIDENT next presented to Mr. Booth, of Southport (late of Middlesbrough), a handsome timepiece, as the Association's recognition of his services as Auditor.

Mr. BOOTH thanked the members, and said that, although he was resigning the position of Auditor on account of his removal, he did not intend to relinquish his connection with the Association.

Mr. J. H. PENNEY (South Shields) was unanimously appointed Auditor, in place of Mr. Booth.

On the motion of Mr. HEPWORTH, seconded by Mr. SELLERS, a hearty vote of thanks was accorded to the President for successfully conducting the business of the meeting; and, on the motion of Mr. WOODALL, seconded by Mr. COX, the thanks of the Association were given to the Mayor and Corporation of Stockton for their courtesy.

Alderman DODDS, M.P., acknowledged the compliment.

On the motion of the PRESIDENT, votes of thanks were also passed to Messrs. Blair and Co., for opening their works, and for the attention shown to the members during their inspection.

It was agreed that the next meeting should be held in Newcastle-upon-Tyne.

The company then adjourned to the Masonic Hall for dinner. The President officiated as Chairman, with Alderman Dodds, M.P., on his right, and Alderman Knowles on his left. Mr. Cox, of Sunderland, occupied the vice-chair, supported by Alderman Hunton and Mr. Craggs. After dinner, the usual loyal and patriotic toasts were proposed, Colonel Sadler responding for the services. Mr. Sellers proposed "The Houses of

Parliament," to which Mr. Dodds replied. Alderman Knowles proposed "The North of England Association of Gas Engineers," which was responded to by the Chairman, who next gave "Kindred Associations," in acknowledging which Mr. Nelson observed that he believed it was the first time they had been honoured by the presence of a member of Parliament, and that it would be a mutual advantage if the occurrence were more frequent, as in that case Parliamentary Committees would be better able to legislate on questions relating to gas. Mr. Woodall, of Leeds, proposed "The Press," to which Mr. Allan responded. Mr. Hepworth gave "The President," and felicitated him upon the great success that had attended the day's proceedings. The toast was drunk with acclamation. In responding, the President proposed the health of their Honorary Secretary, which was duly responded to.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

(*Continued from page* 472.)

The PRESIDENT (Mr. R. Mitchell, of Coatbridge), at the close of his Address, reported in the JOURNAL for the 23rd ult., invited discussion on

THE PROPOSED AMALGAMATION OF THE ASSOCIATION WITH THE NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Mr. M'GILCHRIST (Dumbarton) suggested the advisability of postponing any decision on the question, as there was so small a meeting. He thought the matter might be talked over; but it should be distinctly understood that no motion should be made on the subject, and that the ultimate disposal of the question should be postponed until the next meeting.

Mr. NIVEN (Dunoon) asked the form of amalgamation which had been suggested, so that some material resolution for the next meeting might be passed.

The SECRETARY (Mr. Dalziel, of Kilmarnock) said that the minute of the 29th of August last, which narrated the steps taken by the Committee with a view to union with the North British Association of Gas Managers, stated that it was proposed by Mr. Stewart, and seconded by Mr. Dalziel —"That instead of an amalgamation of the two Associations, District Associations be arranged, and a Central Association, of which District Associations would be members; and that this Central Association be supported from funds of District Associations. It was agreed that this motion be laid before the meeting of the West of Scotland Association at the Bridge of Allan, for consideration, and at the annual meeting in April next for decision."

The PRESIDENT said the amalgamation would not be of such a nature as to sink both Associations in one; but the West of Scotland Association would be more limited in its scope. Under the amalgamation, if carried out, Scotland would be divided into districts, and the members resident in those districts could meet as frequently as they chose, and discuss any questions bearing on the profession.

Mr. ADAMSON (Anstruther) said he understood the proposal was somewhat akin to the General Assembly and Presbyteries.

Mr. M'GILCHRIST said that was his proposal, but he was sorry to say it was not adopted by the Committee. It was rather agreed that the amalgamation should be somewhat after the principle adopted by the Freemasons—namely, that there should be district associations which should support the grand lodge. The difficulty he saw to that plan was that there were so few District Associations. He thought all should belong to the Central Association, and that the Central Association should allocate the districts to the different District Associations, and that was the principle of the Assembly and the Presbyteries. He did not see how the other plan could be worked. It was like supplying a town from service-pipes instead of from the fountain head—the gasholder. In the present state of matters he did not see that the negotiations would come to anything.

Mr. RENFREW (Langbank) asked if the North British Association would acquiesce in that idea. As he understood it, the proposal was for an amalgamation pure and simple.

Mr. M'GILCHRIST said he belonged to the Committee of the North British Association, and at several meetings the subject had been taken up and talked over, and both they and certain members of the West of Scotland Association had thought it would be better if there was one strong Association, having meetings extending over two or three days, rather than having them divided over different periods of the year. The North British Association admitted that the West of Scotland Association had done a large amount of good work, with their schemes in connection with the Benevolent Fund and with the publication of the statistics of the gas supply of Scotland, and he thought they should make it a point that these two schemes should be carried out. Then it was considered that the name of the new Association should not be the North British Association, because it would look as if it were swallowing up the West of Scotland Association. Some members would throw both titles overboard, and adopt a name such as the Scottish Association of Gas Managers; and that at the outset the West of Scotland should send one-half the members of Committee, and the North British the other half, in order to work out the scheme, so that the interests of both Associations could be looked after—and then the members of Committee could be balloted for by members of the whole Association. The North British Association members considered that if the Associations were to amalgamate, the work would be more cheaply done, and a greater number would pay into the Benevolent Fund, and thus much more could be accomplished. The scheme had his sympathy, and he thought the sooner there was union the better for all concerned.

Mr. NAPIER (Crieff) said he did not know whether the North British Association were prepared to come forward with a similar amount of funds as the West of Scotland Association possessed, but he understood they were pretty strong. He should like to know whether that point had ever been discussed.

Mr. M'GILCHRIST said that Mr. Alex. Smith of Aberdeen, the late President of the North British Association, had stated that he had no doubt the members would be able to bring forward as much money per member as the West of Scotland Association. In regard to the Benevolent Fund, some of the members pleaded that the West of Scotland Association members would not be so narrow as to limit the benefit of it to themselves, because the fund was not altogether subscribed by them, there being members of the North British Association who subscribed to it. The only question was for the North British Association to say whether they should pay up per member on the Benevolent Fund as well as on the Association Fund.

Mr. H. AITKEN (Falkirk) asked the amount of the Benevolent Fund.

The PRESIDENT said there was about £120. He also stated that subscriptions were received even from English managers; hence the reason for assisting the widow of the late Mr. Laming.

The SECRETARY said the main point for which the West of Scotland Association was established had been overlooked, which was that managers of small works could meet together and talk over matters which they could not do if they had to address a larger audience. At present all were resident in a limited area, knew each other, and could talk freely on any difficulties with which they might have to contend. If they were members of a large Central Association, papers would be brought forward by the more prominent members, in the discussion of which managers of smaller works could hardly take a share. The thing wanted was to keep up freeness of discussion, and to encourage younger members to come forward with papers. As a rule, it was found that the managers of small works were working men, and diffident of expressing their opinions. His idea was that by having a Central Association the meetings could be so arranged for the District Associations that the former could meet when the managers were all at liberty, and the members of the District Associations could attend the meetings of the Central Associations, and not be called upon to pay further subscription. This could be managed by the District Associations paying so much into the district fund to maintain the Central Association, and every manager in Scotland would thus be a member of the Central Association. This would bring the managers better together in a certain sense, and still leave freedom to discuss papers amongst themselves.

Mr. RENFREW thought such an arrangement would be all very well so far as the Central Association was concerned, but it would not be very convenient to have these meetings coming on immediately after a district meeting. He did not see any benefit that would result from having first a district meeting and afterwards a three days meeting of the Central Association.

Mr. AITKEN said either they should remain as they were, two separate Associations, with all their advantages and disadvantages, or amalgamate as one Central Association, and take with it all its advantages and disadvantages. He would not express an opinion, without being more thoroughly informed in regard to the funds and other particulars, as to the course which ought to be followed, but thought it should be one or other of the two ways indicated.

Mr. ADAMSON apprehended that the West of Scotland Association would receive the whole of the members of the North British Association were they to come individually, and no question would be asked in regard to funds; the only difference was, they were coming collectively. Still, if the matter was considered, there was no more difference than if they were to come individually; yet, now, coming as a body, it was said they must produce so much money.

Mr. M'GILCHRIST said the North British Association considered the matter much as Mr. Aitken did, that there must be an amalgamation pure and simple, or the two Associations had better remain as they were, and he thought they were prepared for the latter course.

Mr. CHEYNE (Briton Ferry) said he thought, if the idea of having District Associations were carried out, the members would just be drifting into the error they were trying to avoid in the South.

The PRESIDENT said the fact was being overlooked that it was intended to have a Central as well as District Associations.

Mr. AITKEN said he would advise either to have one large Association, or have the two separate, as at present.

It was then agreed to leave the decision of the question till the next meeting of the Association in April.

Mr. J. HUTCHISON (Portrush), at the last meeting of the Association, submitted the following paper. It was not then read, but had been since printed, and was in the hands of the members. It was therefore now taken as read, and the discussion commenced.

TWENTY-CANDLE GAS FOR SCOTLAND.

In presenting for your consideration this feeble effort at a paper on the desirability of introducing 20-candle gas as the national standard of lighting in Scotland, and contending for its application, I feel somewhat like a soldier on a forlorn hope about assaulting a fortress strongly commanded by a garrison who may combat ably for its defence, and the approach to which has hitherto been checked by a formidable resistance. Notwithstanding a probable repetition of the opposing element in question, I am fully persuaded that the standard which you have raised so high must inevitably come down to suit the altered circumstances of the time, and be replaced by one more analogous to, and in accordance with the practical usages of other countries. Already there are indications of gas being called into active requisition for other purposes than lighting. In England, great and rapid strides are being made to develop its use as a driving power instead of steam, and also for the purpose of heating and cooking on an extensive scale. If you wish to be participators in similar advantages, you can only do it by assimilating your degree of illuminating power as near as possible to that of other countries, in order to render it more available not only for lighting, but also as a very desirable and profitable medium for producing engine-driving and substantial cooking and heating power. With the present high quality it would be superfluous to argue its adaptability to promote that end. Counterpoises and arguments of a nature to reject and doubt the expediency and practicability of a transformitory method of working cannot be seriously entertained by members of the profession elsewhere. I may be wrong in the following declaration, but I have no hesitation in affirming it, that no question can be of more momentous import for your earnest consideration than this. It is without doubt an erroneous idea that pervades the minds of some Scotch managers, that a cessation of working at a high standard would involve serious consequences to consumers. The notion that good gas cannot be manufactured at a lower quality, I hold to be a complete fallacy. A sufficient index of its value is manifest by comparing the public lighting of such cities as Edinburgh and Glasgow with London and Dublin. Take the lower mode of working with the big flame; it bears favourable comparison with the small and sometimes very smoky light of the Scotch gas. I also place little faith in what I call the hitherto abortive attempts that have been made at lowering the rate of illuminating power, and represented as experimental trials of its utility. I do not like to be positive or dogmatic, but I am afraid such trials were made by passing crude gas, under the impression that it was the right method of producing an efficacious lowering of the standard. No sufficient test of its merits can be applied without a substitution of larger burners and a reduction of the working pressure. As to impurities, I have been working for the past winter at an average power of 17 candles, and have not had a single complaint from consumers either as to quality or choked fittings. The absence of the latter is evidence of its purity. This is effected without the use of cannel, and the carbonization brought about with the highest possible heats that iron retorts can bear, yielding 9000 feet per ton of coal without an exhauster, working pressure 12-10ths, loss (per returns of meters) by leakage, &c., 6 per cent. This result being easily accomplished at a small works, what may not be done on large works with exhaustive appliances? I would urge you to make an earnest trial of its merits. And I am sure its efficacy as the better plan, all things considered, will become so apparent as to make you wonder at the tardiness and reluctance with which you were actuated in effecting the substitution.

In dealing with a subject of this importance, I confess at the outset that it is no easy task for an outsider to grapple with it, when the object sought is at direct variance with the manner and working of an existing system, and more particularly one that has been long cherished as the *beau-idéal* in its relation to a high standard of illuminating power. When gas as a new science was first introduced into Scotland as a light-giving power, it

was never anticipated that this great industry would have assumed such gigantic proportions as to have imperilled the lasting powers of the material selected for its manufacture. The first consideration, and the most natural one, that influenced the minds of its promoters was the procuring of the best means adaptable to obtaining the highest amount of illuminating power. In this respect, Scotland was more fortunate than England in possessing a very superior and rich coal, prolific in gas-producing power, and, as then thought, equal to supply all demands made upon it. So sprang into existence the manufacture of gas in Scotland by means of rich cannel. England, on the other hand, not being possessed of rich cannel, suited her means to the ends, and so also sprang into existence the manufacture of gas of a lower standard of illuminating power. Now, in comparing the modes of working of the two countries respectively, is it not apparent that the early promoters of gas in Scotland overshot the mark when they selected cannel coal to provide the gas of the future? No doubt they were actuated by the best motives when they judged cannel to be the best agent to employ in the enterprise, but there is also no question that they judged wrongly, and the gas manufacturers of the present day are paying the penalty caused by the indiscretion of their predecessors. While manufacturers of gas in England are moving on prosperously in the "even tenor" of their ways, undisturbed unless by that bogie—the electric light—Scotch manufacturers are restless and uneasy at the future prospect of a dearth of cannel. Then, in the face of all this, I cannot think it wise or prudent to withhold the acceptance of an arrangement so much calculated to secure a permanent supplying power, and so obviously pregnant with such superior advantages in its adaptability to existing circumstances as relating to supply and demand.

In this progressive age changes of a revolutionary character have sometimes to be endured to meet the exigencies of the time and its attendant eventualities; and labour, inconvenience, and expense in their realization have to be considered very often secondary objects. Viewed in this light, and as bearing on the subject before us, no barrier, I think, should be raised to stop the way to the introduction of a mode of working that will not only settle this long vexed question of utilizing economically that precious commodity, rich cannel, but will be also instrumental in furnishing better results to all concerned.

On looking at the JOURNAL OF GAS LIGHTING for Nov. 21, 1876, I observed a paper on the same subject by Mr. L. Monk, which was read to the members of this Association. That gentleman, after showing, by much powerful reasoning, unquestionable grounds for this desirable change, by a reduction of the illuminating power, fortifies his position in the advocacy of the question by quoting several good authorities on the subject. I may be pardoned if I also refer to the same source, as the particular authorities in question are gentlemen of great repute in Scotland.

I find Mr. M'Crae, a veteran in the profession, in giving a lecture at Dundee, is represented as having spoken in strong condemnatory terms of the wholesale waste in supplying such unnecessarily rich gas. The loss to consumers alone in Dundee in one year, he affirmed, amounted to £15,000 through imperfect combustion. This is surely a bad state of things, if true, which I have no reason to doubt. I find also that this same gentleman gave sufficient evidence that it was precarious to continue to impose such a drain on the first-class cannel, to the jeopardizing of its very existence. He also, in his concluding remarks, stated that he did "not fear the consequences of being subjected to the use of 18 or 20 candle gas, being quite certain that, with proper care, a better and much cheaper light will be enjoyed from gas of that quality, than what, as a rule, is got at present." Such testimony coming from such a source surely speaks volumes in favour of a change.

Mr. Foulis, also, in an address he delivered to the North British Association in 1874, refers to the same important subject. After a very discursive treatment of the question of the coal supply, he admitted that the increased price of cannel was such as to render the manufacture of gas difficult to make both ends meet, and he went on to show that shale as a substitute for rich cannel, after a fair trial, had only given partial success, on account of the small production of gas per ton; and further expressed the opinion that, as richer cannel was worked out, the quality of gas must be reduced, and he further believed that ultimately it would be necessary to lower the illuminating power all over Scotland. This I also conclude to be a valuable admission in favour of a change. But Mr. Foulis, in his concluding remarks, observed that considerable difficulty in making a change would be encountered in adapting a low standard of illuminating power to the existing interior house-fittings, on account of the smallness of the piping used. Mr. Foulis, I am glad to observe, fears no other difficulty than the supposed inadequate house-fittings. This is also favourable, as I think I can prove further on that this objection may be easily removed. It is very plain that Mr. Foulis would not hesitate much in adapting present working plant to a new condition of things, for he also declared that he believes that as good a light may be had from 20-candle gas as with the present high quality with its imperfections.

Mr. G. R. Hislop, another good authority to draw from, when addressing the North British Association at Dundee in 1865, said that it was beyond all doubt that Scotch gas companies would find no relief until they lowered the standard of illuminating power to 20 or 22 candles, and that, further, he had no doubt that with properly-adapted means of combustion it would prove to the advantage of all. Proportionately, such gas could be supplied much cheaper, as it would enable them to draw their supplies more largely from the abundant supplies of third-class cannel, and also to utilize more extensively the many excellent splint coals with which the country abounds. He concluded, that force of circumstances would undoubtedly ere long bring such a change about. This testimony of Mr. Hislop's was given many years ago, and possibly those managers who may be averse to a lowering of illuminating power may take shelter under the wing of this, and declare that we are no worse yet, and our supplies are still being kept up. "What is the use of bothering ourselves about it? It may last our time." My reply to such would be—"Husband your means, so that you can leave behind you some portion of it to your successors. Do not impoverish them by squandering it all away, that they may be brought to poverty. This year, next year, or forty years hence, makes no difference as to the limit of supply of rich cannel. It is undoubtedly limited to narrow proportions, and should be preserved from wholesale waste by unnecessary draining when other coal is plenteous."

Again, Mr. Hislop testifies in a paper he read before the North British Association at Edinburgh, in 1867, two years later, that "it is an alarming fact that within two years our cannel coals have increased in price to the extent of from 40 to 50 per cent., thereby rendering a general increase in the price of gas throughout Scotland an absolute necessity;" and he attributes the cause of this to the mighty draining to supply the foreign markets, and the increasing demands of English companies, and concludes by expressing the opinion that the rich cannel, with such demands made upon it, "must soon be exhausted." I deem this emergency of a great increase in price, which Mr. Hislop refers to, may come again with increased force. The number of gas-works abroad is steadily on the increase, and each one additional that is added will bear the more heavily on your cannel by the increased demand.

Mr. Stewart, in addressing the North British Association at Edinburgh, in 1876, alluded to the question in his Inaugural Address, but expressed great fears if any saving would be effected by the manufacture of gas of a low quality, and thought that if a cheaper class of coal were used in great quantities they would be increased in price until they equalled any increased value got for the coke. Mr. Stewart, also, in dealing with the burner question, did not seem to place much confidence in the attempts that were being made to improve the method of combustion by their means, and adverted to the inconvenience and trouble that might be caused to consumers with such burners, in keeping them clear, even if made effective otherwise. This declaration of his shows conclusively to me that Mr. Stewart is not satisfied with the imperfect combustion, and would be glad to embrace a better state of things, more particularly when he admits that if a change of quality were to be introduced, it must be generally adopted all over Scotland. In his conjecture as to the possibility of the price of a common coal being enhanced so as to render nugatory the value that would be received from the sale of coke, I can hardly agree with Mr. Stewart in the view he takes, because there would be ample quantity of third-class cannel and splint coals to meet all demands, to prevent any extraordinary increase in price; besides, there would be the English market to fall back upon in such a case.

I will now ask your attention for a moment to Dr. Wallace's remarks, in addressing the North British Association in 1874 on this same question. The Doctor is presumably no admirer of a lower quality of gas, for he says "it cannot be doubted that a supply of gas of a comparatively high illuminating power is desirable, independent altogether of cost;" and goes on to say, "If we wish in an apartment a certain amount of light, we must vitiate the air to nearly double the extent if we employ common gas, such as that used in Birmingham and London—12 to 16 candles—than we require to do with Glasgow or other 22 to 28 candle cannel gas, with a corresponding increase of temperature." As regards sulphur, it is even worse; and he argues "that for equal quantities of light there is about four times as much sulphurous acid produced in burning common gas as compared with cannel." He further goes on to say, "This is a serious evil, and accounts to a large extent for the comparatively limited use of gas in the better class of houses in London and other large English towns." Certainly the Doctor presents a fair case for the rejection of a lower standard, if true in practice; but I am afraid that, in making his test as to the relative qualities of common gas, as against cannel, he must have taken a very impure sample of the first to base his conclusions upon. If he tested respectively each gas from the ascension-pipe or hydraulic main, then I could quite agree with his conclusions. No one knows better than the Doctor that a low standard of illuminating power does not necessarily imply impure gas; besides, he leaves a very wide gap for selecting a general average of illuminating power when he takes his standpoint between 12 and 16 and 22 and 28 candles respectively, thus rendering it hard to judge what power is most acceptable, all things considered.

From a long experience in the gas business in England, more particularly in London, I can certify that a comparatively limited use of gas in houses is not due to the cause the Doctor attributes. The main cause is on account of landlords not furnishing the necessary piping into houses, as they do in Scotland; but this applies chiefly to houses of a second and third class, and not generally to first-class dwellings, these being rarely without gas. For a comparison of sulphur impurities as between the English Gas Companies and Scotch, I have selected from the JOURNAL OF GAS LIGHTING the following.* I find the Glasgow Commissioners gas is reported as having an average illuminating power of from 27 to 29 candles, at several stations. The Dalmarnock gas had over 14 grains of sulphur per 100 feet, and the Partick over 21 grains, with a slight portion of ammonia in each. At the several stations of The Gaslight and Coke Company, London,† I find their common gas had an average illuminating power of about 17 candles, and the average of sulphur did not exceed 10 grains per 100 feet, and no trace of sulphuretted hydrogen. From this it is certain that Dr. Wallace did not do the English gas companies full justice when he implied that, on account of impurities, the use of gas was limited in London and other large towns.

Now, weighing the opinions of these excellent authorities I have just quoted *pro* and *con.*, it seems to me that in drawing deductions there is a preponderating result of a favourable character as to the desirability of a change in regard to the supplying of gas at such a high rate of illuminating power, and this, too, on Scotch ground alone. I would ask, then, is it not time that a new system should be inaugurated? What better opportunity could there be than the present for carrying out such a beneficial step, with the iron market so low in supplying prices? and, besides, the trade of the country, now in a languishing condition, would receive an impetus, so very desirable at this crisis, by the augmentation of the necessary plant required to meet the new condition of things. Again, symptoms of shortening supplies of rich cannel are apparent, by the fact of seeking after other means of enriching substitutes. Already several ingenious contrivances are in the market, but I fear, from the additional cost they entail in their application, that they will not meet with general approval. Nothing to my mind can be more simple, more effective, more remunerative, and likely to prove more lasting in feeding the gas market with an abundant supply for some time to come, than gas manufactured from common gas coal, with a small percentage of rich cannel. By its adoption, and made to the standard of 20-candle gas, there may be sufficient high-class cannel left to fall back upon for all enriching purposes for an indefinite period, and in the meantime you could afford to throw overboard, so to speak, all those assumed enriching expedients that are at present in the market. In glancing over the yearly report furnished by this Association, I found therein favourable evidence to show that many of the gas-works in Scotland are provided with apparatus of sufficient capacity for the purpose required in providing for increased consumption. Assuming an increase in retort power applied, this, I apprehend, would not be very difficult, if there be sufficient oven space to fall back upon, so as to increase the number of retorts in a setting. I also found that the works referred to as possessing ample apparatus are chiefly of modern construction, and those in many instances that show such niggardly capacities for supplying power are necessarily, from their primitive state, much in need of reconstruction. Assuming, then, that all well-conditioned works—and I wish it to be understood that I believe all those in the chief towns of Scotland are—had their wheels set in motion to manufacture 20-candle gas, say, for convenience sake, in the summer time, what formidable difficulties have to be encountered? None that I can see. At such a time of the year circumstances would be favourable for initiating the scheme, testing its merits, and regulating the requirements before the winter set in. There need be no fear of the want of adequate supplying power and storeage. At such a period of the year, warehouses, manufactories, &c., would release you in some measure from the disturbing element of danger of a rebellious nature from the consumers. The dwelling-houses, theatres, and public businesses alone would have to be met to start with. The change, I submit, if applied, ought to be of an almost simultaneous description, and generally advertised all over the country as a necessity, so as to make it more acceptable to the public.

I may be permitted to offer a few practical hints that are founded

* See JOURNAL, June 6, 1876, Vol. XXVII., p. 870.

† See JOURNAL, Oct. 17, 1876, Vol. XXVIII., p. 564.

on an extensive experience with regard to meters and inferior fittings, in their application to a supposed introduction of 20-candle gas, for it is to these alone that the chief hindrance to a successful working may occur. First, with regard to meters. My opinion is that the smallest sized meters—Nos. 0 and 1—should be abolished altogether, and replaced by No. 2; for this reason, that they are very doubtful in their accuracy, and very liable to stop registering altogether, and, besides, have been voted long ago a nuisance by gas managers. No. 2, on account of small consumers being numerous in Scotland, would, in my opinion, be a necessary evil on that account. If otherwise, I would use nothing less than No. 3 to begin with, and applying a rule for guidance in the regulating and re-arrangement of meters to render them adaptable to the supply of gas of a lower quality, I would multiply the size of the meter by double its own number—say, for example, six lights to a three-light meter, and so on, and arrange accordingly. This I hold to be a good rule in practice, and I have known it to be adopted both in England and abroad. Frequently much trouble has come under my notice through neglect in companies servants attaching meters of inadequate size to meet the requirements needed. Secondly, as to interior gas-fittings. These are worse to contend with, as they are not the property of gas companies. However, if 20-candle gas be established, consumers must, in the language made use of by Mr. Foulis, be educated up to it, and submit to have any defective fittings rectified. This would, of course, only apply to a certain class of piping, and not to fixtures; and, even with regard to piping, any alterations that would be required, I think, would be exceedingly limited, as the application of larger meters would in most cases suffice. This I am assured of, from an intimate knowledge of the gas-fitting business in Edinburgh and Glasgow. The worst objection I would anticipate is the excessive use of brass couplings. They are, I admit, a necessity to some extent with the using of rich gas, on account of the condensation that is so liable to be created by that high quality; but it would be better if they could be dispensed with, as they are often a hindrance to an even flow of gas, from their tendency to choke up.

With an acceptance of 20-candle gas, it would be desirable to embrace with it a new method of gas-fitting more in accordance with the English system, which consists in the application of piping of larger bore—nothing less than ¾-in.—no coupling, but blow-pipe joints. This method possesses great advantages with gas of a low quality, and also by its economy to consumers.

Again, the advantages derived from the manufacture of gas of lower standard of illuminating power is conspicuously shown by reference to any English balance-sheet, so frequently to be seen in the JOURNAL OF GAS LIGHTING. I have drawn upon a few, to prove the value of coke and other residuals. At Scarborough, Yorkshire, I find from the yearly report*—

Sept. 25, 1876—			
The consumption of coal cost	£10,013	9	0
Purifying material, including £50 for water	242	16	9
Profits from sale of coke, tar, and liquor	4,021	9	1

At Brighton, I find from the half-yearly report† that—

Sept. 25, 1876—			
The consumption of coal cost	£13,481	3	11
Purifying material	396	4	0
Sale of coke, tar, and liquor	5,559	7	5

At Preston, in Lancashire, and near to coal-fields—

Coal and cannel cost	£10,837	18	6
Manufacturing expenses, lime, water, and wages	8,028	15	8¼

the latter of which is more than covered by the sale of coke, tar, &c. Comparing these results with that of Scotch companies, I think it will be manifest to all minds that the English mode of working is the most profitable, and that this is chiefly owing to the value of their residuals. But it may be urged that in England there is a good sale for coke; while in Scotland the people will not buy it, as coal is so cheap. Coal, I would reply, is also cheap in Lancashire, and yet there is a ready sale for coke. Let the Scotch gas companies become gaslight and coke companies, and it will soon be seen whether coke will not sell. It is bound to sell, if a good article, because it is preferable, for many purposes, to coal, irrespective of cost. The people in the town that I represent can get coal at present from 13s. to 16s. 6d. per ton, yet I can sell all the coke I make for 20s. a ton.

It appears to me that, in continuing to retain your present system of manufacturing such a high and excessive quality of gas, you are not only imperilling your supply of rich cannel, but you are also continuing to imperil your own interests—companies and consumers alike. By adopting 20-candle gas as the gas of the future, you will manifestly increase your consumption, and be enabled to give the consumers the benefit of a reduced price.

The value of residuals, the savings of common coal for furnace work, the opportunity of minimizing furnaces by adding to the number of retorts to a setting, the saving of fuel to be effected thereby, the absence of waste by imperfect combustion at the consumer's burner, the freedom from soot, and many other grievances, are well worthy of being noticed as advantages to be gained by the adoption of 20-candle gas.

I will now conclude by making a few observations of an argumentative character as bearing on the opposition that has hitherto been employed against the introduction of 20-candle gas. When Mr. Monk's paper on the same subject was discussed in 1877, I had not the pleasure of being present, or I would undoubtedly have taken exception and come into collision with the expressed view of some of the members of this Association who combated against the practicability and desirability of working at a lower standard. For example, Mr. Stewart urged that there was a mistaken idea abroad that we use large quantities of first-class cannel to produce the high quality of gas supplied in Scotland. Now, I beg to differ from him on that point; and say, with all respect, that it is a mistaken idea. What Mr. Stewart does, and can do, at the works he so ably superintends is no criterion or argument to justify such a conclusion being applied to all Scotch works. That the impressions of outsiders are not erroneous, is evident by reference to the great demands made on rich cannel by the solicitations for tenders. I also hold it to be a feeble plea in opposition to urge that when the rich coal becomes scarcer, then we shall be driven to use an inferior coal. Such is not, commercially speaking, the usual mode of dealing with an enterprise of much value. Suppose, on the same principle, our cloth manufacturers were to fear a great falling off in the growth of cotton in America and India, would they not take immediate steps to fortify themselves against such an emergency by resorting to other channels for an adequate supply? It would be deemed hazardous and unbusiness-like to content themselves by saying, "Oh, we will wait till the supply is scarcer." What the consequences would be to them in such an event would, I hold, be in the same way applicable to the Scotch gas manufacturers, if they delay recognizing the urgent need of a change so imminent. Mr. Stewart also, in common with Mr. Young, seemed to put implicit faith in the introduction of the analyzer, deeming it to be the great antidote and balm of Gilead for restoring the equilibrium of the Scotch idol, the high illuminating standard. By its means alone, one of our esteemed members (Mr. Monk) was suddenly changed from a disciple of 20-candle gas, and became, amongst others, a strong advocate of the analyzer, on the assumption that it would prove the El Dorado for producing the rich gas of the future. Now, let us inquire into the progress of this invention. It is now over two years ago since it was applied at an important town in this same county. I would ask, has it or has it not fulfilled all the requirements? Echo answers me, "No." This is clear from its absence now at the works in the town where it was first applied, and where its admirers were jubilant of success as to its being the ruling agent to mollify the qualms of conscience of gas managers in Scotland as to the future in supplying a high standard. It is with no motive of hostility to the inventor of the analyzer, or with the view of disparaging what I am sure is the production of an able man, that I have entered into this matter. My only motive is to prove that it is not applicable to fulfil all the requirements as a substitute for rich cannel, as advanced in argument. Then, again, I think Mr. Stewart slightly exaggerated—I hope he will pardon me for saying so—when he assumed that English works required to be double the size of Scotch works to produce the same quantity of light. I deem I am nearer the mark of correctness when I say a trifle over one-third larger is a fair ratio, as bearing on 14-candle gas, and, of course, less still would do with 20-candle gas. This is important, and not to be lost sight of. If it were possible, as Mr. Stewart stated, to produce 40-candle gas instead of reducing it to 20 candles, it would be less deleterious to health. Such a statement, emanating from such a good authority, must have been uttered inadvertently, because it is a well-established fact that gas, even at a low standard, when well purified, is not deleterious to health, if used in a properly-ventilated room. It takes very little inquiry into the chemistry part of the question to prove this. Then it occurs to me that if there were introduced a 40-candle gas, which Mr. Stewart sensibly admits is not possible, I am afraid, like the electric light, it would furnish more occupation for oculists and spectacle-makers by its adoption.

Mr. Young, whom I admire as an excellent authority on the chemistry of gas lighting, comes into close conflict with the opinions of some of the gentlemen already quoted, when he contends that we have an abundant supply of material for producing rich gas; but I suppose Mr. Young had under his eye the analyzer, which promised such great things. It is hardly possible to think that he meant an abundance of rich cannel. Mr. Young, however, judging from my point of view, handled the subject ably; nevertheless I cannot consistently agree with all his conclusions. For instance, he thinks it would be well, if possible, to have a supply of rich gas for lighting, and a poor gas for heating purposes, thus implying that it would be the right course to adopt, but an impracticable one. I should have been better pleased if Mr. Young had shown what a combination of the two qualities would do in effecting both purposes, for right well he knows how. It seems to me, in discussing this question, the Scotch managers are forgetful of the fact that there is a wide difference between 14 or 15 and 20 candle gas. I am not aware of any foreign or outside pressure having been advanced for a lower degree of quality. Not even the JOURNAL OF GAS LIGHTING has ever mooted a lower standard.

Then, in dealing with the lower pressure, which I agree with Mr. Young is necessary in burning a poor quality of gas, I have to say his estimate of the relative difference of consumption of the two gases, in feet per hour, is based on the assumption of employing 14-candle as against a high standard. Altering the figure 5 feet per hour to 4 feet would be a nearer approach in its application to 20 candles in the producing of a maximum of illuminating power. I am not at one with Mr. Young as to his theory that the flame of a low quality of gas is so much affected by air currents as he represents it to be. My attention has not at any time been attracted to any inconvenience by that means. However, granting Mr. Young to be correct in his conclusions, it is, nevertheless, a very slight obstacle to bar the way to its acceptance. Another admission of Mr. Young's, and I hold it to be the strongest that can be advanced, is the working of a lower quality with a diminished pressure. The fruits that would arise from this are increased economy by the greater absence of condensation and leakage. Can it therefore be further doubted that this, which I may be allowed to call the "use and wont" system of supplying such an unnecessarily high quality, should not be brought to an early termination? Is the subject not ripe enough for consideration as a measure of expediency? What! with an overwhelming verdict of the whole gas profession against you in North and South America, France, Germany, Russia, Italy, and other countries as to the greater utility of a lower working being so universally recognized and accepted, should it not be convincing proof of the desirability of a change, irrespective of any other consideration?

Might I be thought too bold, as a comparative stranger and humble member of the rear ranks of the profession, when I assert that it is a duty incumbent on the managers of the largest towns to lead the van and take the initiative step in this important matter, and save the interest of the great industry of gas lighting in Scotland from being imperilled by the jeopardizing element of shortening supplies of cannel which is so imminent.

Discussion.

Mr. NIVEN said that, so far as he could see, the principal argument in the paper for restricting the quality of gas supplied in Scotland to 20 candles, was that high-class cannels were limited in quantity, that they were gradually becoming scarcer, and that in these circumstances it behoved gas managers to reduce the standard and use less high-class coals. The writer pointed out that he produced 17-candle gas without the use of any cannel, and that he had no complaint as to the quality. Then the very fact of there being cannel made no difference, and what was to be done with the cannel if it was not used? He (Mr. Niven) did not think in this respect that Mr. Hutchison had produced any reason at all for his contention, because he could not show the advantage of a non-using of the cannel. Then Mr. Hutchison took notice of the existing circumstances of supply and demand. He (Mr. Niven) believed it was within the experience of most gas managers in Scotland that if they supplied 20-candle gas they would find complaint, and whatever might be the feeling in some parts of Ireland and England, he was afraid it would be necessary to reverse the well-known Beaconsfieldian expression, and educate the people down to 20 candles. The demand at present was for higher and better light rather than the reduction of it, and there was evidence of this in the electric light and the introduction of Sugg's improved burners. Mr. Hutchison thought that Mr. M'Crae, Mr. Foulis, and Mr. Hislop all approved of 20-candle gas, and quoted Mr. M'Crae's words, to the effect that £15,000 a year was lost by consumers in Dundee through imperfect combustion, forgetful all the while that this had reference to the manner of consumption, and not to the quality of the gas. Perhaps managers in Scotland had not been paying the same attention to the question as to the best conditions under which to consume gas so as to get its full value, as had been done in England, and the question in his (Mr. Niven's) opinion resolved itself more into one of burners. Then Mr. Foulis brought forward the objection in regard to common gas, that the interior fittings would be inadequate, and Mr. Hutchison concluded that this objection could be easily removed. All would be desirous to know how he proposed to remove the objection. Further, he said that consumers must submit to the

* See JOURNAL, Vol. XXVIII., p. 343.
† Vol. XXVIII., p. 344.

was never anticipated that this great industry would have assumed such gigantic proportions as to have imperilled the lasting powers of the material selected for its manufacture. The first consideration, and the most natural one, that influenced the minds of its promoters was the procuring of the best means adaptable to obtaining the highest amount of illuminating power. In this respect, Scotland was more fortunate than England in possessing a very superior and rich coal, prolific in gas-producing power, and, as then thought, equal to supply all demands made upon it. So sprang into existence the manufacture of gas in Scotland by means of rich cannel. England, on the other hand, not being possessed of rich cannel, suited her means to the ends, and so also sprang into existence the manufacture of gas of a lower standard of illuminating power. Now, in comparing the modes of working of the two countries respectively, is it not apparent that the early promoters of gas in Scotland overshot the mark when they selected cannel coal to provide the gas of the future? No doubt they were actuated by the best motives when they judged cannel to be the best agent to employ in the enterprise, but there is also no question that they judged wrongly, and the gas manufacturers of the present day are paying the penalty caused by the indiscretion of their predecessors. While manufacturers of gas in England are moving on prosperously in the "even tenor" of their ways, undisturbed unless by that bogie—the electric light—Scotch manufacturers are restless and uneasy at the future prospect of a dearth of cannel. Then, in the face of all this, I cannot think it wise or prudent to withhold the acceptance of an arrangement so much calculated to secure a permanent supplying power, and so obviously pregnant with such superior advantages in its adaptability to existing circumstances as relating to supply and demand.

In this progressive age changes of a revolutionary character have sometimes to be endured to meet the exigencies of the time and its attendant eventualities; and labour, inconvenience, and expense in their realization have to be considered very often secondary objects. Viewed in this light, and as bearing on the subject before us, no barrier, I think, should be raised to stop the way to the introduction of a mode of working that will not only settle this long vexed question of utilizing economically that precious commodity, rich cannel, but will be also instrumental in furnishing better results to all concerned.

On looking at the JOURNAL OF GAS LIGHTING for Nov. 21, 1876, I observed a paper on the same subject by Mr. L. Monk, which was read to the members of this Association. That gentleman, after showing, by much powerful reasoning, unquestionable grounds for this desirable change, by a reduction of the illuminating power, fortifies his position in the advocacy of the question by quoting several good authorities on the subject. I may be pardoned if I also refer to the same source, as the particular authorities in question are gentlemen of great repute in Scotland.

I find Mr. M'Crae, a veteran in the profession, in giving a lecture at Dundee, is represented as having spoken in strong condemnatory terms of the wholesale waste in supplying such unnecessarily rich gas. The loss to consumers alone in Dundee in one year, he affirmed, amounted to £15,000 through imperfect combustion. This is surely a bad state of things, if true, which I have no reason to doubt. I find also that this same gentleman gave sufficient evidence that it was precarious to continue to impose such a drain on the first-class cannel, to the jeopardizing of its very existence. He also, in his concluding remarks, stated that he did "not fear the consequences of being subjected to the use of 18 or 20 candle gas, being quite certain that, with proper care, a better and much cheaper light will be enjoyed from gas of that quality, than what, as a rule, is got at present." Such testimony coming from such a source surely speaks volumes in favour of a change.

Mr. Foulis, also, in an address he delivered to the North British Association in 1874, refers to the same important subject. After a very discursive treatment of the question of the coal supply, he admitted that the increased price of cannel was such as to render the manufacture of gas difficult to make both ends meet, and he went on to show that shale as a substitute for rich cannel, after a fair trial, had only given partial success, on account of the small production of gas per ton; and further expressed the opinion that, as richer cannel was worked out, the quality of gas must be reduced, and he further believed that ultimately it would be necessary to lower the illuminating power all over Scotland. This I also conclude to be a valuable admission in favour of a change. But Mr. Foulis, in his concluding remarks, observed that considerable difficulty in making a change would be encountered in adapting a low standard of illuminating power to the existing interior house-fittings, on account of the smallness of the piping used. Mr. Foulis, I am glad to observe, fears no other difficulty than the supposed inadequate house-fittings. This is also favourable, as I think I can prove further on that this objection may be easily removed. It is very plain that Mr. Foulis would not hesitate much in adapting present working plant to a new condition of things, for he also declared that he believes that as good a light may be had from 20-candle gas as with the present high quality with its imperfections.

Mr. G. R. Hislop, another good authority to draw from, when addressing the North British Association at Dundee in 1865, said that it was beyond all doubt that Scotch gas companies would find no relief until they lowered the standard of illuminating power to 20 or 22 candles, and that, further, he had no doubt that with properly-adapted means of combustion it would prove to the advantage of all. Proportionately, such gas could be supplied much cheaper, as it would enable them to draw their supplies more largely from the abundant supplies of third-class cannel, and also to utilize more extensively the many excellent splint coals with which the country abounds. He concluded, that force of circumstances would undoubtedly ere long bring such a change about. This testimony of Mr. Hislop's was given many years ago, and possibly those managers who may be averse to a lowering of illuminating power may take shelter under the wing of this, and declare that we are no worse yet, and our supplies are still being kept up. "What is the use of bothering ourselves about it? It may last our time." My reply to such would be—"Husband your means, so that you can leave behind you some portion of it to your successors. Do not impoverish them by squandering it all away, that they may be brought to poverty. This year, next year, or forty years hence, makes no difference as to the limit of supply of rich cannel. It is undoubtedly limited to narrow proportions, and should be preserved from wholesale waste by unnecessary draining when other coal is plenteous."

Again, Mr. Hislop testifies in a paper he read before the North British Association at Edinburgh, in 1867, two years later, that "it is an alarming fact that within two years our cannel coals have increased in price to the extent of from 40 to 50 per cent., thereby rendering a general increase in the price of gas throughout Scotland an absolute necessity;" and he attributes the cause of this to the mighty draining to supply the foreign markets, and the increasing demands of English companies, and concludes by expressing the opinion that the rich cannel, with such demands made upon it, "must soon be exhausted." I deem this emergency of a great increase in price, which Mr. Hislop refers to, may come again with increased force. The number of gas-works abroad is steadily on the increase, and each one additional that is added will bear the more heavily on your cannel by the increased demand.

Mr. Stewart, in addressing the North British Association at Edinburgh, in 1876, alluded to the question in his Inaugural Address, but expressed great fears if any saving would be effected by the manufacture of gas of a low quality, and thought that if a cheaper class of coal were used in great quantities they would be increased in price until they equalled any increased value got for the coke. Mr. Stewart, also, in dealing with the burner question, did not seem to place much confidence in the attempts that were being made to improve the method of combustion by their means, and adverted to the inconvenience and trouble that might be caused to consumers with such burners, in keeping them clear, even if made effective otherwise. This declaration of his shows conclusively to me that Mr. Stewart is not satisfied with the imperfect combustion, and would be glad to embrace a better state of things, more particularly when he admits that if a change of quality were to be introduced, it must be generally adopted all over Scotland. In his conjecture as to the possibility of the price of a common coal being enhanced so as to render nugatory the value that would be received from the sale of coke, I can hardly agree with Mr. Stewart in the view he takes, because there would be ample quantity of third-class cannel and splint coals to meet all demands, to prevent any extraordinary increase in price; besides, there would be the English market to fall back upon in such a case.

I will now ask your attention for a moment to Dr. Wallace's remarks, in addressing the North British Association in 1874 on this same question. The Doctor is presumably no admirer of a lower quality of gas, for he says "it cannot be doubted that a supply of gas of a comparatively high illuminating power is desirable, independent altogether of cost;" and goes on to say, "If we wish in an apartment a certain amount of light, we must vitiate the air to nearly double the extent if we employ common gas, such as that used in Birmingham and London—12 to 16 candles—than we require to do with Glasgow or other 22 to 28 candle cannel gas, with a corresponding increase of temperature." As regards sulphur, it is even worse; and he argues "that for equal quantities of light there is about four times as much sulphurous acid produced in burning common gas as compared with cannel." He further goes on to say, "This is a serious evil, and accounts to a large extent for the comparatively limited use of gas in the better class of houses in London and other large English towns." Certainly the Doctor presents a fair case for the rejection of a lower standard, if true in practice; but I am afraid that, in making his test as to the relative qualities of common gas, as against cannel, he must have taken a very impure sample of the first to base his conclusions upon. If he tested respectively each gas from the ascension-pipe or hydraulic main, then I could quite agree with his conclusions. No one knows better than the Doctor that a low standard of illuminating power does not necessarily imply impure gas; besides, he leaves a very wide gap for selecting a general average of illuminating power when he takes his standpoint between 12 and 16 and 22 and 28 candles respectively, thus rendering it hard to judge what power is most acceptable, all things considered.

From a long experience in the gas business in England, more particularly in London, I can certify that a comparatively limited use of gas in houses is not due to the cause the Doctor attributes. The main cause is on account of landlords not furnishing the necessary piping into houses, as they do in Scotland; but this applies chiefly to houses of a second and third class, and not generally to first-class dwellings, these being rarely without gas. For a comparison of sulphur impurities as between the English Gas Companies and Scotch, I have selected from the JOURNAL OF GAS LIGHTING the following.* I find the Glasgow Commissioners gas is reported as having an average illuminating power of from 27 to 29 candles, at several stations. The Dalmarnock gas had over 14 grains of sulphur per 100 feet, and the Partick over 21 grains, with a slight portion of ammonia in each. At the several stations of The Gaslight and Coke Company, London,† I find their common gas had an average illuminating power of about 17 candles, and the average of sulphur did not exceed 10 grains per 100 feet, and no trace of sulphuretted hydrogen. From this it is certain that Dr. Wallace did not do the English gas companies full justice when he implied that, on account of impurities, the use of gas was limited in London and other large towns.

Now, weighing the opinions of these excellent authorities I have just quoted *pro* and *con.*, it seems to me that in drawing deductions there is a prepondering result of a favourable character as to the desirability of a change in regard to the supplying of gas at such a high rate of illuminating power, and this, too, on Scotch ground alone. I would ask, then, is it not time that a new system should be inaugurated? What better opportunity could there be than the present for carrying out such a beneficial step, with the iron market so low in supplying prices? and, besides, the trade of the country, now in a languishing condition, would receive an impetus, so very desirable at this crisis, by the augmentation of the necessary plant required to meet the new condition of things. Again, symptoms of shortening supplies of rich cannel are apparent, by the fact of seeking after other means of enriching substitutes. Already several ingenious contrivances are in the market, but I fear, from the additional cost they entail in their application, that they will not meet with general approval. Nothing to my mind can be more simple, more effective, more remunerative, and likely to prove more lasting in feeding the gas market with an abundant supply for some time to come, than gas manufactured from common gas coal, with a small percentage of rich cannel. By its adoption, and made to the standard of 20-candle gas, there may be sufficient high-class cannel left to fall back upon for all enriching purposes for an indefinite period, and in the meantime you could afford to throw overboard, so to speak, all those assumed enriching expedients that are at present in the market. In glancing over the yearly report furnished by this Association, I found therein favourable evidence to show that many of the gas-works in Scotland are provided with apparatus of sufficient capacity for the purpose required in providing for increased consumption. Assuming an increase in retort power applied, this, I apprehend, would not be very difficult, if there be sufficient oven space to fall back upon, so as to increase the number of retorts in a setting. I also found that the works referred to as possessing ample apparatus are chiefly of modern construction, and those in many instances that show such niggardly capacities for supplying power are necessarily, from their primitive state, much in need of reconstruction. Assuming, then, that all well-conditioned works—and I wish it to be understood that I believe all those in the chief towns of Scotland are—had their wheels set in motion to manufacture 20-candle gas, say, for convenience sake, in the summer time, what formidable difficulties have to be encountered? None that I can see. At such a time of the year circumstances would be favourable for initiating the scheme, testing its merits, and regulating the requirements before the winter set in. There need be no fear of the want of adequate supplying power and storeage. At such a period of the year, warehouses, manufactories, &c., would release you in some measure from the disturbing element of danger of a rebellious nature from the consumers. The dwelling-houses, theatres, and public businesses alone would have to be met to start with. The change, I submit, if applied, ought to be of an almost simultaneous description, and generally advertised all over the country as a necessity, so as to make it more acceptable to the public.

I may be permitted to offer a few practical hints that are founded

* See JOURNAL, June 6, 1876, Vol. XXVII., p. 870.

† See JOURNAL, Oct. 17, 1876, Vol. XXVIII., p. 564.

on an extensive experience with regard to meters and inferior fittings, in their application to a supposed introduction of 20-candle gas, for it is to these alone that the chief hindrance to a successful working may occur. First, with regard to meters. My opinion is that the smallest sized meters—Nos. 0 and 1—should be abolished altogether, and replaced by No. 2; for this reason, that they are very doubtful in their accuracy, and very liable to stop registering altogether, and, besides, have been voted long ago a nuisance by gas managers. No. 2, on account of small consumers being numerous in Scotland, would, in my opinion, be a necessary evil on that account. If otherwise, I would use nothing less than No. 3 to begin with, and applying a rule for guidance in the regulating and re-arrangement of meters to render them adaptable to the supply of gas of a lower quality, I would multiply the size of the meter by double its own number—say, for example, six lights to a three-light meter, and so on, and arrange accordingly. This I hold to be a good rule in practice, and I have known it to be adopted both in England and abroad. Frequently much trouble has come under my notice through neglect in companies servants attaching meters of inadequate size to meet the requirements needed. Secondly, as to interior gas-fittings. These are worse to contend with, as they are not the property of gas companies. However, if 20-candle gas be established, consumers must, in the language made use of by Mr. Foulis, be educated up to it, and submit to have any defective fittings rectified. This would, of course, only apply to a certain class of piping, and not to fixtures; and, even with regard to piping, any alterations that would be required, I think, would be exceedingly limited, as the application of larger meters would in most cases suffice. This I am assured of, from an intimate knowledge of the gas-fitting business in Edinburgh and Glasgow. The worst objection I would anticipate is the excessive use of brass couplings. They are, I admit, a necessity to some extent with the using of rich gas, on account of the condensation that is so liable to be created by that high quality; but it would be better if they could be dispensed with, as they are often a hindrance to an even flow of gas, from their tendency to choke up.

With an acceptance of 20-candle gas, it would be desirable to embrace with it a new method of gas-fitting more in accordance with the English system, which consists in the application of piping of larger bore—nothing less than ¾-in.—no coupling, but blow-pipe joints. This method possesses great advantages with gas of a low quality, and also by its economy to consumers.

Again, the advantages derived from the manufacture of gas of lower standard of illuminating power is conspicuously shown by reference to any English balance-sheet, so frequently to be seen in the JOURNAL OF GAS LIGHTING. I have drawn upon a few, to prove the value of coke and other residuals. At Scarborough, Yorkshire, I find from the yearly report*—

Sept. 25, 1876—			
The consumption of coal cost	£10,013	9	0
Purifying material, including £50 for water	242	16	9
Profits from sale of coke, tar, and liquor	4,021	9	1

At Brighton, I find from the half-yearly report† that—

Sept. 25, 1876—			
The consumption of coal cost	£13,481	3	11
Purifying material	396	4	0
Sale of coke, tar, and liquor	5,559	7	5

At Preston, in Lancashire, and near to coal-fields—

Coal and cannel cost	£10,837	18	6
Manufacturing expenses, lime, water, and wages	8,028	15	8½

the latter of which is more than covered by the sale of coke, tar, &c. Comparing these results with that of Scotch companies, I think it will be manifest to all minds that the English mode of working is the most profitable, and that this is chiefly owing to the value of their residuals. But it may be urged that in England there is a good sale for coke; while in Scotland the people will not buy it, as coal is so cheap. Coal, I would reply, is also cheap in Lancashire, and yet there is a ready sale for coke. Let the Scotch gas companies become gaslight and coke companies, and it will soon be seen whether coke will not sell. It is bound to sell, if a good article, because it is preferable, for many purposes, to coal, irrespective of cost. The people in the town that I represent can get coal at present from 13s. to 16s. 6d. per ton, yet I can sell all the coke I make for 20s. a ton.

It appears to me that, in continuing to retain your present system of manufacturing such a high and excessive quality of gas, you are not only imperilling your supply of rich cannel, but you are also continuing to imperil your own interests—companies and consumers alike. By adopting 20-candle gas as the gas of the future, you will manifestly increase your consumption, and be enabled to give the consumers the benefit of a reduced price.

The value of residuals, the savings of common coal for furnace work, the opportunity of minimizing furnaces by adding to the number of retorts to a setting, the saving of fuel to be effected thereby, the absence of waste by imperfect combustion at the consumer's burner, the freedom from soot, and many other grievances, are well worthy of being noticed as advantages to be gained by the adoption of 20-candle gas.

I will now conclude by making a few observations of an argumentative character as bearing on the opposition that has hitherto been employed against the introduction of 20-candle gas. When Mr. Monk's paper on the same subject was discussed in 1877, I had not the pleasure of being present, or I would undoubtedly have taken exception and come into collision with the expressed view of some of the members of this Association who combated against the practicability and desirability of working at a lower standard. For example, Mr. Stewart urged that there was a mistaken idea abroad that we use large quantities of first-class cannel to produce the high quality of gas supplied in Scotland. Now, I beg to differ from him on that point; and say, with all respect, that it is a mistaken idea. What Mr. Stewart does, and can do, at the works he so ably superintends is no criterion or argument to justify such a conclusion being applied to all Scotch works. That the impressions of outsiders are not erroneous, is evident by reference to the great demands made on rich cannel by the solicitations for tenders. I also hold it to be a feeble plea in opposition to urge that when the rich coal becomes scarcer, then we shall be driven to use an inferior coal. Such is not, commercially speaking, the usual mode of dealing with an enterprise of much value. Suppose, on the same principle, our cloth manufacturers were to fear a great falling off in the growth of cotton in America and India, would they not take immediate steps to fortify themselves against such an emergency by resorting to other channels for an adequate supply? It would be deemed hazardous and unbusiness-like to content themselves by saying, "Oh, we will wait till the supply is scarcer." What the consequences would be to them in such an event would, I hold, be in the same way applicable to the Scotch gas manufacturers, if they delay recognizing the urgent need of a change so imminent. Mr. Stewart also, in common with Mr. Young, seemed to put implicit faith in the introduction of the analyzer, deeming it to be the great antidote and balm of Gilead for restoring the equilibrium of the Scotch idol, the high illuminating standard. By its means alone, one of our esteemed members (Mr. Monk) was suddenly changed from a disciple of 20-candle gas, and became, amongst others, a strong advocate of the analyzer, on the assumption that it would prove the El Dorado for producing the rich gas of the future. Now, let us inquire into the progress of this invention. It is now over two years ago since it was applied at an important town in this same county. I would ask, has it or has it not fulfilled all the requirements? Echo answers me, "No." This is clear from its absence now at the works in the town where it was first applied, and where its admirers were jubilant of success as to its being the ruling agent to mollify the qualms of conscience of gas managers in Scotland as to the future in supplying a high standard. It is with no motive of hostility to the inventor of the analyzer, or with the view of disparaging what I am sure is the production of an able man, that I have entered into this matter. My only motive is to prove that it is not applicable to fulfil all the requirements as a substitute for rich cannel, as advanced in argument. Then, again, I think Mr. Stewart slightly exaggerated—I hope he will pardon me for saying so—when he assumed that English works required to be double the size of Scotch works to produce the same quantity of light. I deem I am nearer the mark of correctness when I say a trifle over one-third larger is a fair ratio, as bearing on 14-candle gas, and, of course, less still would do with 20-candle gas. This is important, and not to be lost sight of. If it were possible, as Mr. Stewart stated, to produce 40-candle gas instead of reducing it to 20 candles, it would be less deleterious to health. Such a statement, emanating from such a good authority, must have been uttered inadvertently, because it is a well-established fact that gas, even at a low standard, when well purified, is not deleterious to health, if used in a properly-ventilated room. It takes very little inquiry into the chemistry part of the question to prove this. Then it occurs to me that if there were introduced a 40-candle gas, which Mr. Stewart sensibly admits is not possible, I am afraid, like the electric light, it would furnish more occupation for oculists and spectacle-makers by its adoption.

Mr. Young, whom I admire as an excellent authority on the chemistry of gas lighting, comes into close conflict with the opinions of some of the gentlemen already quoted, when he contends that we have an abundant supply of material for producing rich gas; but I suppose Mr. Young had under his eye the analyzer, which promised such great things. It is hardly possible to think that he meant an abundance of rich cannel. Mr. Young, however, judging from my point of view, handled the subject ably; nevertheless I cannot consistently agree with all his conclusions. For instance, he thinks it would be well, if possible, to have a supply of rich gas for lighting, and a poor gas for heating purposes, thus implying that it would be the right course to adopt, but an impracticable one. I should have been better pleased if Mr. Young had shown what a combination of the two qualities would do in effecting both purposes, for right well he knows how. It seems to me, in discussing this question, the Scotch managers are forgetful of the fact that there is a wide difference between 14 or 15 and 20 candle gas. I am not aware of any foreign or outside pressure having been advanced for a lower degree of quality. Not even the JOURNAL OF GAS LIGHTING has ever mooted a lower standard.

Then, in dealing with the lower pressure, which I agree with Mr. Young is necessary in burning a poor quality of gas, I have to say his estimate of the relative difference of consumption of the two gases, in feet per hour, is based on the assumption of employing 14-candle as against a high standard. Altering the figure 5 feet per hour to 4 feet would be a nearer approach in its application to 20 candles in the producing of a maximum of illuminating power. I am not at one with Mr. Young as to his theory that the flame of a low quality of gas is so much affected by air currents as he represents it to be. My attention has not at any time been attracted to any inconvenience by that means. However, granting Mr. Young to be correct in his conclusions, it is, nevertheless, a very slight obstacle to bar the way to its acceptance. Another admission of Mr. Young's, and I hold it to be the strongest that can be advanced, is the working of a lower quality with a diminished pressure. The fruits that would arise from this are increased economy by the greater absence of condensation and leakage. Can it therefore be further doubted that this, which I may be allowed to call the "use and wont" system of supplying such an unnecessarily high quality, should not be brought to an early termination? Is the subject not ripe enough for consideration as a measure of expediency? What! with an overwhelming verdict of the whole gas profession against you in North and South America, France, Germany, Russia, Italy, and other countries as to the greater utility of a lower working being so universally recognized and accepted, should it not be convincing proof of the desirability of a change, irrespective of any other consideration?

Might I be thought too bold, as a comparative stranger and humble member of the rear ranks of the profession, when I assert that it is a duty incumbent on the managers of the largest towns to lead the van and take the initiative step in this important matter, and save the interest of the great industry of gas lighting in Scotland from being imperilled by the jeopardizing element of shortening supplies of cannel which is so imminent.

Discussion.

Mr. NIVEN said that, so far as he could see, the principal argument in the paper for restricting the quality of gas supplied in Scotland to 20 candles, was that high-class cannels were limited in quantity, that they were gradually becoming scarcer, and that in these circumstances it behoved gas managers to reduce the standard and use less high-class coals. The writer pointed out that he produced 17-candle gas without the use of any cannel, and that he had no complaint as to the quality. Then the very fact of there being cannel made no difference, and what was to be done with the cannel if it was not used? He (Mr. Niven) did not think in this respect that Mr. Hutchison had produced any reason at all for his contention, because he could not show the advantage of a non-using of the cannel. Then Mr. Hutchison took notice of the existing circumstances of supply and demand. He (Mr. Niven) believed it was within the experience of most gas managers in Scotland that if they supplied 20-candle gas they would find complaint, and whatever might be the feeling in some parts of Ireland and England, he was afraid it would be necessary to reverse the well-known Beaconsfieldian expression, and educate the people down to 20 candles. The demand at present was for higher and better light rather than the reduction of it, and there was evidence of this in the electric light and the introduction of Sugg's improved burners. Mr. Hutchison thought that Mr. M'Crae, Mr. Foulis, and Mr. Hislop all approved of 20-candle gas, and quoted Mr. M'Crae's words, to the effect that £15,000 a year was lost by consumers in Dundee through imperfect combustion, forgetful all the while that this had reference to the manner of consumption, and not to the quality of the gas. Perhaps managers in Scotland had not been paying the same attention to the question as to the best conditions under which to consume gas so as to get its full value, as had been done in England, and the question in his (Mr. Niven's) opinion resolved itself more into one of burners. Then Mr. Foulis brought forward the objection in regard to common gas, that the interior fittings would be inadequate, and Mr. Hutchison concluded that this objection could be easily removed. All would be desirous to know how he proposed to remove the objection. Further, he said that consumers must submit to the

* See JOURNAL, Vol. XXVIII., p. 343.
† Vol. XXVIII., p. 344.

reduction, but he (Mr. Niven) did not consider that argument, because it was not a question of imperative necessity, and the best plan was to make all possible use of the means at present available. Mr. Hutchison also quoted Dr. Wallace as to the comparative vitiation of the air by the use of common as against cannel gas. Now, it was well known that common gas was a greater vitiater of the air than cannel gas, and, that being so, Dr. Wallace was quite right. Further, it was also well known that there was more sulphur in other forms of combination in common than in cannel coal, and that produced more sulphurous acid. To say, therefore, that Dr. Wallace must have been testing at the ascension-pipe when he was taking the gas as it was sold, did not, he thought, show a good spirit. Then Mr. Hutchison said that Dr. Wallace took his standpoint between 12 to 16, and 22 to 28 candles respectively, thus rendering it hard to judge what power was most acceptable, all things considered. The simple state of the matter was that Dr. Wallace brought the ratios out as 12 to 22, or as 16 to 28, and Mr. Hutchison did not see that. Then Mr. Hutchison found fault with Mr. Stewart because he would rather go in for a higher standard. If, for instance, gas of 30 candles vitiated the air less than 15-candle gas, it followed by a parity of reasoning that if 40-candle gas could be produced the air would be still less vitiated. Touching on another topic, he asserted that the analyzer had been a failure, because it had not been in action for about two years; but he (Mr. Niven) might remark that one day when he was in Hamilton he heard the workmen speak very highly of it, and at that time it had been in action for a considerable period. Considering the thoroughly scientific principles on which the analyzer was based, it ought to do well, and if it did well for one manufacturer, it ought to do well for any number. As a matter of fact, it had done well for Mr. Bell, at Gibraltar, and there must be some reason why it was not at work in Hamilton.

Mr. AITKEN said that, after the reference to his analyzer in the President's address, it was quite unnecessary for him to enter upon the subject further than to say that the analyzer was right for 16-candle gas and for 30-candle gas. Excluding altogether considerations that must weigh in special circumstances as to certain coals, pipes and fittings, and arrangements made for certain qualities of gas, and taking into account the habits of the people, the broad point to be settled, he apprehended, was this—What quality of gas was it most beneficial for people to burn? There could be but one answer to the question, and that was the higher the illuminating power, and the purer the quality of the gas, the better. It could serve no purpose to consume a large quantity of air and gas, provided the same amount of light could be obtained for the same amount of money from a richer gas, the use of which vitiated less air.

Mr. M'GILCHRIST said he thought if Mr. Hutchison had been a gas manager in Scotland, where people had been so long accustomed to high illuminating power, he would not have advocated a 20-candle standard. It might be, as Mr. Niven had remarked, that if the people were educated down to 20-candle gas there might not be any complaint; but, seeing that Scotland was so favourably situated for an abundant supply of good coal, he thought the gas world would look upon Scotch gas managers as being rather foolish not to make use of the material that was near at hand. If 30-candle gas could be supplied, he thought, on the authority of Mr. John Young, that it would be cheaper in the end. While in Hull, that gentleman sold his gas at 2s. 6d. per 1000 feet during the coal famine, and yet he said he would prefer to use 30-candle gas for illuminating purposes at 6s. per 1000 feet than Hull gas at 2s. 6d. Another point, entirely omitted by Mr. Hutchison, had been referred to by Mr. Aitken, and that was—What was the good of using 20-candle gas if it was not possible to supply light more cheaply? In Scotland, light was cheaper (at a higher price) than in England, simply because it was not necessary to use so much gas to get an equal amount of light. He did not think it would be economical for the English and Irish to supply gas of a high illuminating power, because they would have such a high price to pay for carriage; but as long as there was cannel coal it ought to be used. By the time cannel coal was exhausted, he had no doubt inventions would be introduced and completed that would bring out a higher illuminating power than any coal could produce at the present time, and he thought, therefore, it would be wrong to cease to give gas of high illuminating power because of a certain dread that cannels would become exhausted.

Mr. R. BROWN (New Cumnock) said if the exhaustion of cannel coal was the only reason for reducing the high standard of gas in Scotland, it might with safety be ignored. For 15 years he had taken an active interest in the supply of cannel coal, and, having studied the fields in Scotland, had some knowledge on the subject, and he asserted that for another generation, if not two, there would be a sufficient supply for Scotland and all other nations.

Mr. JEFFREY considered it would be time enough to reduce the standard of illuminating power when the article to produce it had been exhausted.

The PRESIDENT said that what pleased one class of consumers would not please another, even though separated by only a short distance. Two years ago he had occasion to be in London in reference to his Company's Bill in Parliament. The standard mentioned in it was 20 candles, and on Lord Redesdale reading the clause, he said, "That is a good gas, pass it;" and so it was passed. He might, however, state that they had never taken advantage of the clause. The quality of the gas supplied was a matter of circumstances more than anything else. If there was sufficient material at hand to give rich gas, it ought to be given, as people had so long been accustomed to a high standard.

(To be continued.)

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is still only a very moderate amount of improvement to report in the coal trade of this district, and this is confined almost entirely to house-fire classes of fuel, the demand for which is naturally increasing with the approach of winter. The advance in prices which was made by one firm in the Manchester district at the commencement of the month is being followed to some extent by others, and generally throughout Lancashire there is a firmer tone in the better classes of round coal, sellers of which are not willing to enter into long forward deliveries at present rates. Most of the house-coal collieries are now getting on to full time, and prices are generally steady at about 8s. to 8s. 6d. per ton for best Wigan Arley; 6s. to 7s. for common sorts; and 6s. to 6s. 9d. for good Pemberton four feet. For gas-making coals there are very few fresh inquiries reported in the market, as the season for giving out contracts is now practically over; but although there is nothing upon which to base any quotations, it is probable that if buyers had to give out orders at present, they would scarcely be able to do so at the prices which were being freely taken a month or so back. In other descriptions of fuel there is no material change. In some cases a slight improvement is reported in the demand for common round coal for iron-making purposes, but not to such an extent as to have any effect on the market, whilst engine fuel is still generally a drug. For common round coal at the pit mouth very low prices are still being taken, and the average quotations range from 4s. 6d. to 5s. 3d. per ton; burgy can be bought at from 3s. 6d. to 4s. 3d., and good slack at from 2s. 6d. to 3s. 3d., with common sorts offering at almost any figure.

Coke suitable for iron-making purposes is rather better to sell, but this branch of trade is still generally dull.

In the iron market there has been a decidedly weaker tone during the last few days, and, where holders have to push sales, considerably lower prices have to be accepted. Many of the makers, however, are so well sold that they are for the present tolerably independent of new orders, and, consequently, they are not making any alteration in their list rates. Lancashire makers of pig iron have not only sold all their production for several months to come, but have been making heavy deliveries out of stock, and their quoted prices for delivery into Manchester are about 50s. per ton for No. 3 foundry, less 2½ per cent. In finished iron there has not been the upward movement in prices which was anticipated, but a considerable advance upon late rates is maintained, and for Lancashire bars delivered into the Manchester district the quoted prices are about £6 to £6 5s. per ton.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

A considerable amount of business has been transacted in contracting for the supply of Durham gas coals. Several large contracts have been made for best qualities over the past week or ten days. Most of the contracts run twelve months, but some have been done for two and three years. There has been an advance of 2½ per cent. in values, but the rise in no instance has exceeded 6d. per ton. Business is improving amongst the second-class pits in this trade, though the demand is not nearly so strong as it is for best sorts. Under the present circumstances of the coal trade of the North of England the gas collieries in the Durham district have every prospect of full employment over the winter. There has been a substantial advance in the price of coke too. Heavy contracts have been made to supply iron-works, especially the hematite iron-works of Cumberland and North Lancashire, over a series of months. An advance of 1s. per ton has been established. Manufacturing and small coals have been more asked after, but prices are comparatively unaltered. House coals do not show any change in price. Steam coals are firm, but there is no alteration of rates, nor is there likely to be any in this trade until next March.

The wild rush up of prices in the Cleveland iron trade has turned out, as indicated in this column last week, to be a mere gambling transaction by Glasgow speculators. It was largely in the hands of weak houses, who could not hold. Prices, which went wild on Monday and Tuesday, received a sudden check on Wednesday, Thursday, and Friday, and the market has been calming down since. That there has been a substantial increase of orders from the United States is undoubted, mainly for hematite iron for Bessemer; but that there was any warrant for the markets getting into high fever, it was clear to men of common sense and experience there was none. It is the same with copper, tin, lead, and other metals, and it is believed they, with iron, were capable of a considerable improvement from legitimate demand; but that it warranted a leap up of £2 a ton, as some of them showed, was out of the question.

There is still a short supply of steam and sailing tonnage in the coal ports. The shipments of gas coals have, therefore, got below an average. At the same time freights have advanced a little. There seems to be quite enough steam tonnage for the London market. The freights are about 4s. 1½d.; sailing ships are able to realize about 5s. per ton, to load at the wharf. A fair amount of tonnage has been engaged to load gas coals for the English Channel, but some more vessels might be taken up for the North of France if they were forthcoming.

The number of unemployed men seems to increase in the northern towns, and meetings are being held to organize some method of relieving the destitution during the winter. Iron shipbuilding has improved a little over the past fortnight.

MICKLEOVER AND ETWALL GASLIGHT AND COKE COMPANY, LIMITED.—This Company, which was registered on the 1st inst., with a capital of £6000 in £10 shares, proposes to erect works, and to supply the villages of Mickleover and Etwall, in the county of Derby, and places adjacent thereto, with gas and gas products.

CASTLE DONINGTON GAS COMPANY.—The annual meeting of this Company was held last Wednesday—Mr. Towle presiding. From the report, which was read by the Secretary (Mr. Clifford), it appeared that a considerable increase had taken place in the consumption of gas during the past year. The Directors had paid £218 15s. 4d. for re-laying mains, and had a balance of £283 10s. 5d. in hand, out of which they recommended a dividend of 10s. per share (free of income-tax), being at the rate of 5 per cent., the remainder to be carried to the current account. This was agreed to.

EDINBURGH AND DISTRICT WATER SUPPLY.—At a joint meeting of the Finance and Works Committees of the Edinburgh and District Water Trust, held last Wednesday, it was agreed to recommend the Trust to instruct the Law Agent to proceed with the preparation of a Bill, to be promoted in the next session of Parliament, authorizing the borrowing of an additional sum of £200,000 for the purposes of the water undertaking.

SOCIETY OF ENGINEERS.—It is announced that Mr. Perry F. Nursey, who was lately appointed Editor of *Iron*, has resigned his Secretaryship of this Society. In the course of a letter intimating the fact, the President (Mr. R. P. Spice), on behalf of the Council, writes: "We feel that he is entitled to our warmest praise for his assiduous application, and the ability which he has always displayed in the discharge of the duties devolving upon him, and we regret the loss of his services." Mr. Graham Smith, C.E., succeeds Mr. Nursey.

EXTENSION OF THE TROWBRIDGE WATER COMPANY'S DISTRICT.—On Tuesday, the 30th ult., which was the fifth anniversary of the opening of the works, the latest extension of the Company, that to the villages of Studley and Southwick, was formally inaugurated. A month ago a junction was formed with the main near the Barracks, and from this point 2¼ miles of 4 and 3 inch iron pipes have been laid. The work was undertaken by the Company themselves, and has been completed without the slightest interruption to traffic, and to the satisfaction of everybody. Already services have been laid into 66 houses.

EXTENSIONS AT THE WORCESTER GAS-WORKS.—There have recently been carried out some extensive additions to the Worcester Gas-Works, according to the specifications of Mr. Josiah Deakes, the Company's Manager. The principal of these was the telescoping of a holder, erected in 1868 to contain 400,000 cubic feet of gas, so as to increase its capacity to 900,000 cubic feet. The retort-house has been more than doubled in size, and a new engine-house has been built in connection with the exhausters, besides a new purifying-house. Another important addition to the works is a new station-meter, capable of passing 55,000 cubic feet of gas per hour, being more than double the size of the original one.

HULL PUBLIC LIGHTING.—On Thursday last a meeting of the Gas Inquiry Committee of the Hull Town Council was held, and the Town Clerk submitted his report upon the inquiries he had made as to the results of experiments with electric lighting in various towns. The Chairman (Mr. Elam) thereupon moved, and Mr. Field seconded, a motion to the effect that the Council be requested to instruct the Parliamentary Committee to proceed, in the next session of Parliament, for an Act authorizing the Corporation to light the streets of the borough by electricity. In the course of the discussion on this proposal it was suggested to exclude the district supplied with gas by the British Company, it being stated that it would not be possible to obtain the electric light at a cheaper rate than they supplied gas (viz., 2s. 6d. per 1000 feet), and their opposition would thus be removed. Mr. Larard said he believed the information before the Committee was not sufficient to justify them in asking the Corporation to go to Parliament for such a Bill, and moved an amendment to that effect. Mr. Laverack, who seconded the amendment, thought there was nothing to lose, but everything to gain by waiting. The Committee, on a vote being taken, were evenly divided, and it was resolved to leave the final decision of the question to the Town Council at their next meeting.

LANCASTER CORPORATION WATER-WORKS.—Friday, the 3rd inst., was appointed for hearing evidence in an arbitration case which has been for some time pending between the Corporation of Lancaster and Mr. W. J. Garnett, J.P., as to the damage done to some of his moorlands through their being drained by the Corporation for the purposes of their water supply. Mr. J. F. Bateman, C.E., was to be Arbitrator, and counsel appeared to represent both parties, the proceedings to take place at the Surveyors Institute, Great George Street, Westminster. The claim of Mr. Garnett was for £30,000, for damage done to 2800 acres of moorlands above Lancaster (over which a large number of head of grouse have annually been shot), by the drainage of the water off it by the Corporation, under the Lancaster Water-Works Act of 1876. Before the business commenced, the Arbitrator stated that while he should be perfectly willing to hear as much evidence of facts as each side liked to produce before him, he did not desire to hear any evidence of opinion. He would, however, listen to all matters of fact with the greatest attention, and upon them he should form his own opinion, and act upon it in giving his award. The senior counsel for Mr. Garnett thereupon intimated that, after such an expression, it was impossible for his client to proceed with the arbitration, and they withdrew from it. The Arbitrator said that nevertheless he should go on with the case and make his award in writing; but counsel for the Corporation stating that it would be necessary to give the other side notice before they proceeded *ex parte*, the matter was adjourned.

BRADFORD CORPORATION NEW GAS-WORKS.—The Gas Supply Committee of the Bradford Corporation are engaged in the erection of new works of an extensive character, on a large site of land which they have purchased, adjacent to the Great Northern Railway, at a place known as Birk's Hall, between Bowling and Laister Dyke, and not far from the latter place. The present gas-works of the Corporation are in Valley Road, near Manningham Railway Station on the Midland Railway, at Mill Street, nearer the centre of the town, and at Thornton Road. The Valley Road works are an extension of the original scheme of gas supply, but as three places have been found insufficient adequately to supply the wants of the borough, it was determined to erect entirely new works near Birk's Hall and on another plot of ground at Brownroyd, at the opposite extremity of the borough. It is proposed, when the new works are completed, which will take some time, to sell the sites of the works in Mill Street and Thornton Road, and the wants of the town will be met by the works in the Valley Road, at Brownroyd, and at Birk's Hall. The latter place, which is high above the town, presents a busy scene. The first of the retort-houses—a large, massive building, stone on the outside and lined with brick—has been reared, and the iron roof has been placed in position, ready for slating. There will be two chimneys, built of white fire-clay bricks. One of them is well advanced, and the other has risen above the roof. The interior ironwork is neat, and shows some little ornament. One of the gables, which stood partially built during the long frost of last winter, and got a little out of plumb, was taken down, and is now being rebuilt. Two large tanks for the gasholders, one 150 feet and the other 180 feet diameter, are in a forward state. The tanks, which are 33 feet deep, are built of brick coated with cement, with ashlar stone binders. The Corporation are making their own bricks, of which they will require an immense quantity. They have a machine, driven by steam power, which can turn out about 10,000 bricks a day. The clay is drawn direct out of the pit, is passed into the machine, and the bricks come out ready for the kiln. The works are being executed from the designs of Mr. D. Swallow, the Gas Engineer, and are superintended by his nephew, Mr. W. S. Whitehead. Those already in progress are only part of the scheme, which will be most comprehensive and complete when all the details are carried out.—*Leeds Mercury*.

Register of Patents.

1218.—OWEN, S., Coventry, "*Improvements in modes and apparatus for opening and closing cocks and valves, especially applicable to the simultaneous lighting and extinguishing of street and other lamps.*" Provisional protection only obtained. Dated March 27, 1878.

The object of this invention is simultaneously, and from any place, to open and close any number of cocks or valves by the application of pneumatic, hydraulic, or electric power. For this purpose, as regards the pneumatic and hydraulic modes, the taps to be actuated are fitted with a slotted or equivalently formed lever or handle, to which is connected the piston-rod of a small cylinder, the piston of which can be forced in either direction by compressed air or a vacuum, or by hydraulic pressure.

As applied to street or other lamps, the gas-pipe is fitted with a very small branch or jet pipe, starting from below the tap, and reaching to within a short distance of the top of the main burner. The consequence of this arrangement is that the small jet is always alight, and serves to light the main burner when the gas is turned on to the latter.

In the electrical arrangement the gas-pipe is fitted with a similar small jet-pipe, and the tap actuated by means of electricity, the tap being fitted with an electric needle appliance, which takes the place of the lever or handle.

1217.—WILSON, A. F., St. George's Road, Southwark, and DOUGLAS, T., Aldershot, "*Improvements in the construction of furnaces applicable to the heating of gas-retorts or for other purposes.*" Provisional protection only obtained. Dated March 28, 1878.

According to these improvements, a furnace for the combustion of coke or coke breeze, or a mixture of both, of the kind common to gas-works, is deepened as far as is applicable (consistent with the proper clearance of the ash-pan, and with due facility in removing the furnace bars), and is fitted with furnace bars set much closer than is usual, the object being to obtain a considerable depth of fuel, and to burn this fuel in a slow manner, so as only to produce, as the product of combustion in the body of the furnace, a more or less impure carbonic oxide, while at the top of the fuel upon each side of the furnace an air chamber is built, communicating with the external atmosphere as well as with the interior of the furnace. The chamber or chambers convey air for the complete combustion of the carbonic oxide and its conversion into carbonic acid gas, thus combining an economical consumption of fuel with the production of intense heat in the position where this heat is most advantageous for heating the retorts, and also least destructive to the lower parts of the furnace walls, whence the arches which support the setting are sprung.

The front of the furnace is fitted with two doors, one over the other, separate from, and opening and closing independently of each other. These doors may be hung upon a frame so made as to support both; or they may each have a separate frame connected together, the object being to have an upper door to feed the furnace with fuel, and an under one to open in order to clinker the bars or clean it out by.

The furnace is built with a slight slope or batter inwards at the sides, resembling the section of a frustum of a cone, the objects being, first, to bring the air passages as near as possible to the centre of the body of effluent furnace gases; and, secondly, to facilitate the drop of partially consumed fuel, and the ultimate clearance and cleansing of the furnace.

The air-chambers are fitted with doors to check or entirely stop the draught of air by these apertures, when necessary to do so.

1219.—KIRKHAM, T. N., Abingdon Street, Westminster, and CHANDLER, S., Newington, Surrey, "*Improvements in apparatus used in the manufacture of gas.*" Patent dated March 28, 1878.

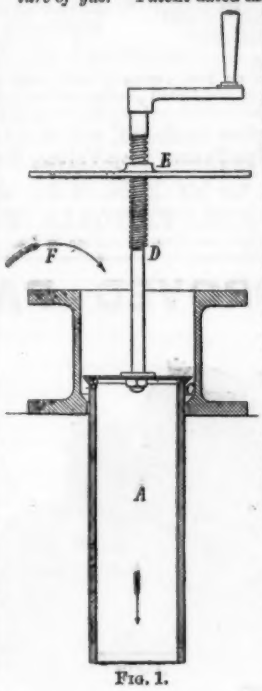

FIG. 1.

This invention relates to the dip-pipe, to the upper end of which is attached a projection piece, truly turned or faced, either cone-shaped or flat. The casting into which this is to fit is also turned, in order that when the two are close together a perfectly sound joint is the result. At the upper end of the dip-pipe is a cross-bar, to which is attached a rod for lifting or lowering. To this rod a screw is fixed, which passes through a flange terminating with a handle for using the apparatus.

The engraving, fig. 1, is a section of the apparatus; and fig. 2 a plan, showing cross-bar. *A* indicates the dip-pipe, the upper part of which is truly faced, so as to fit into the casting *C*, which is likewise truly turned. *D* is the rod and screw for actuating the dip-pipe; and *E* is the screwed flange.

The action of the apparatus is as follows:—

The gas would enter, as indicated by the arrow *F*, and descend through the dip-pipe into the hydraulic main. As soon as the retort is charged and the lid secured, the dip-pipe is lifted out of the liquid in the hydraulic main, and the gas has a free, unobstructed passage. As soon, however, as the charge in the retort has been expended, and before the lid is removed, the dip-pipe is lowered, and becomes immersed in the liquid, while at the same time the faced joints come into contact, thus forming a perfect shut-off between the hydraulic main and the retort out of action.

FIG. 2.

APPLICATIONS FOR LETTERS PATENT.

3963.—BLACKER, D., Thornhill, Yorks, "Improvements in valves and in the method of applying the same for the ventilation of water-mains and similar purposes." Oct. 2, 1879.

3994.—TONGUE, J. G., Chancery Lane, London, "Improvements in the manufacture of gas." A communication. Oct. 4, 1879.

4039.—CHANDLER, S., sen., jun., and J., Newington Causeway, London, "Improvements in gas apparatus." Oct. 7, 1879.

4055.—LAKE, W. R., Southampton Buildings, London, "An improved apparatus for regulating or controlling the pressure and flow of gas or other fluids." A communication. Oct. 7, 1879.

4065.—GRAY, J. W., Holborn, London, "A new or improved gas-tap to determine at will, and render constant the minimum of flame desired." Oct. 8, 1879.

4066.—COCHRANE, A. A., Westminster, "Improvements in gas-burners." Oct. 8, 1879.

4072.—WOLFF, F., Copenhagen, "Improvements in combined pipe-tongs and pipe-cutters." A communication. (Complete specification.) Oct. 8, 1879.

4077.—MACKAY, F. N., Liverpool, "Improvements in and connected with pumps for giving motion to gases and the vapour of volatile fluids." Oct. 9, 1879.

4084.—HENDERSON, A. G., Edinburgh, "Improvements in gas-meters." Oct. 9, 1879.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1334.—RHODES, B., Bow, London, "A novel combination of mineral and vegetable substances to be employed in making steam and water-tight joints, also as a packing for cocks and valves, and other uses for which the said combination of substances is adapted." April 4, 1879.

1341.—WYLDE, R. H., Leeds, "Improvements in cooking apparatus." April 4, 1879.

1384.—LEONI, S., New North Road, London, "Improvements in apparatus for heating and cooking and lighting by gas." April 7, 1879.

1408.—HARVEY, G. W., and SEAL, W. D., Washington, U.S.A., "Improvements in and apparatus for compressing, delivering, and regulating the flow of fluids, adapted to be employed also as a motor or a meter." April 9, 1879.

1450.—HALLEWELL, R., Blackburn, Lancs, "Improvements in gas-engines." April 12, 1879.

1582.—GRANT, J., Boston, U.S.A., "Improvements in filters." April 22, 1879.

1808.—HADDAN, H. J., Westminster, "Improvements in gas-governors." A communication. May 7, 1879.

3068.—LAKE, W. R., Southampton Buildings, London. "Improvements in the manufacture of illuminating gas, and in apparatus therefor." A communication. July 28, 1879.

3213.—ATKINSON, J., Stoke Newington, London, "Improvements in gas and similar engines and mechanism connected therewith, part of such improvements being applicable for other purposes." Aug. 11, 1879.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

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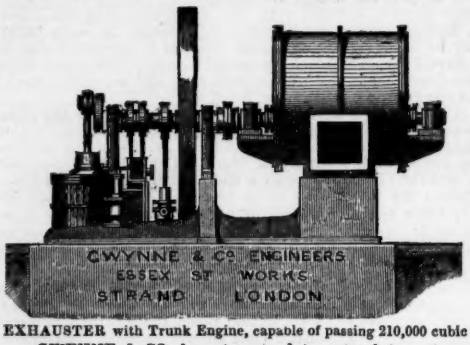

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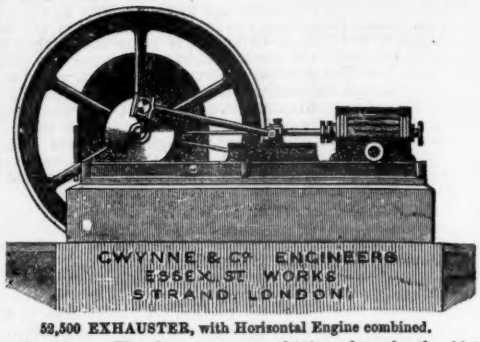
GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



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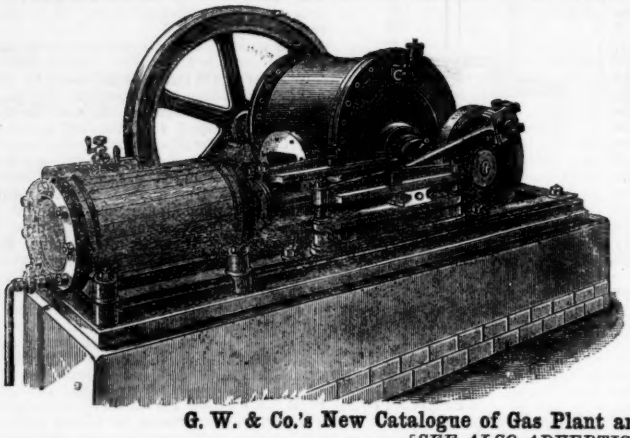

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[*SEE ALSO ADVERTISEMENT, PAGE* 606.]

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WANTED, an energetic, steady, and honest Married Man, to make Gas at the above Works. Assistance from 1st of September to 31st of May. Wages 21s. per week, with house, coals, and gas free. Applicants must be able to read and write.
Address JOHN HENRY LYON, Manager, Gas-Works, Emsworth, HANTS.

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SITUATION wanted, by a young Man, aged 25, as METER INSPECTOR, Index Taker, or Fitter.
Address T. HINE, 2, Mary Ann's Place, Catford, KENT.

WIDNES LOCAL BOARD GAS AND WATER-WORKS.

A Junior Assistant is required at once in the Engineer's Office of these Works. Particulars of duties, &c., can be obtained from the undersigned
HY. ROBERTS, Engineer.
Public Offices, Widnes, Oct. 10, 1879.

FOR SALE—The first 2 Vols. of King's Treatise on the Science and Practice of the Manufacture and Distribution of Coal Gas, in 35 numbers; unsoiled. Price 30s.
Apply to GEO. RUSSELL, Gas-Works, WINDSOR.

FOR SALE—Three Purifiers, 9 ft. by 6 ft by 3 ft. deep, all complete, with grids and bearing bars for same.
The above are for Sale in consequence of having been replaced by larger. No reasonable offer will be refused for the whole or for a portion.
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For price, apply to THOMAS PIGGOTT AND CO., Spring Hill, BIRMINGHAM.

TENDERS FOR CANNEL.

THE Gas Committee of the Belfast Town Council invite TENDERS for the Supply of 500 to 1000 tons of First-class CANNEL, to be delivered immediately.
Tenders must be sent in on or before the 22nd inst.
By order,
JAMES STELFOX.
Belfast, Oct. 13, 1879.

OLDBURY LOCAL BOARD GAS-WORKS.

THE Oldbury Local Board are prepared to receive TENDERS for the Erection of a New GAS-WORKS, to supply their district with gas.
The drawings and specification may be seen on application to the Engineer, Mr. A. Upward, 8, Queen Anne's Gate, Westminster, on and after Wednesday, Sept. 10, 1879, and sealed tenders are to be delivered to me, the undersigned, on or before Monday, Nov. 3, 1879, addressed to the Chairman and Members of the Oldbury Local Board.
Forms of tender may be obtained at the Office of the Engineer on payment of one guinea, which will be returned on the receipt of a *bonâ fide* tender on the form supplied.
The Board do not bind themselves to accept the lowest or any tender.
A. WRIGHT, Solicitor, Clerk to the Board.
Board Room, Oldbury, Sept. 23, 1879.

WEST BROMWICH GAS-WORKS.

CONTRACTS NOS. 3 & 4.

THE West Bromwich Improvement Commissioners are prepared to receive TENDERS from competent persons for the above-mentioned contracts.
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Duplicate copies of the drawings and specifications may be seen, and forms of tender, with quantities, may be obtained (on payment of one guinea for each form of tender, which will be returned in all cases on receipt of a *bona fide* tender on the form supplied) on and after Wednesday, Oct. 8, 1879, on application to the Engineer, Mr. G. W. Stevenson, 38, Parliament Street, Westminster, S.W., or at the Town Hall, West Bromwich, and sealed tenders, properly endorsed, must be delivered on or before Wednesday, October 22 next, at my Offices in the Town Hall, West Bromwich.
The Gas Committee do not bind themselves to accept the lowest or any tender.
CHAS. H. BAYLEY, Clerk.
Town Hall, West Bromwich, Oct. 1, 1879.

THE Gloucester Gas Company, ceasing to manufacture gas at their old works, will have the undermentioned APPARATUS for Sale about the beginning of August, viz.:—
110 Mouthpieces, D-shape, 13 in. by 22 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. 28 Mouthpieces, D-shape, 16 in. by 20 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12 in. Slide-Valves and 12 in. Connections.
Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12 in. Connections.
Exhauster (Jones) to pass about 15,000 feet per hour.
Exhauster (Beales) to pass about 25,000 feet per hour.
Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.
Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.
4-horse power Horizontal Steam-Engine.
Three 4-in. Pumps, with cranked Shafting and a pair Mitre Wheels.
Set of four Purifiers, 12 ft. by 12 ft. by 4 ft., with 12-in. Centre-Valve (Cockeys), and Connections and Lift complete.
Station-Meter by A. Wright and Co., London, with three 12-in. Slide-Valves, and 12-in. Bye-Pass and Connections, to pass about 25,000 feet per hour.
Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.
Gasholder, Double Lift, capacity 100,000 feet.
Gasholder, Double Lift, capacity 240,000 feet.
Two 12-in. Governors, by Wright, London, with 12-in Valves, Bye-Pass, and Connections.
Two 12-in. four-way faced Valves, by Cockey.
For further information, &c., apply to the undersigned.
R. MORLAND, Engineer.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
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Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

SCARBOROUGH GAS-WORKS.

THE Directors of the Scarborough Gas Company are prepared to receive TENDERS for the construction and erection of a Telescopic GASHOLDER.
The drawings and a specification may be seen, and forms of tender obtained (on payment of one guinea, which will be returned if a *bona fide* tender be made according to instructions), on application at the Office of the Manager of the Company, in Scarborough, or at the Office of the Engineer, Mr. G. W. Stevenson, 38, Parliament Street, London, S.W., on and after Wednesday, Oct. 8, 1879, and sealed tenders must be sent in to me, the undersigned, endorsed "Tender for Gasholder," on or before Wednesday, Oct. 22, 1879, not later than Twelve o'clock at noon.
The Directors do not bind themselves to accept the lowest or any tender.
By order,
WILLIAM J. MOON, Manager.
Scarborough, Oct. 4, 1879.

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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HAYMARKET, EDINBURGH.
Established 1840.

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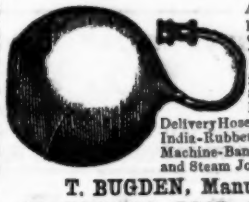

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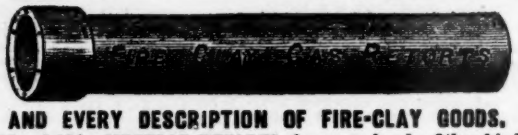

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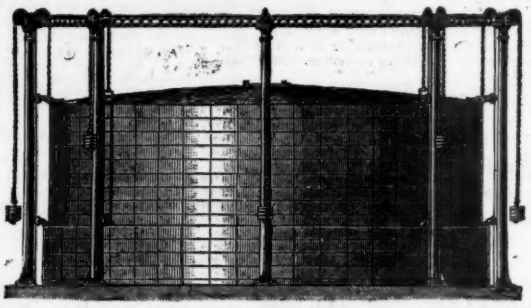

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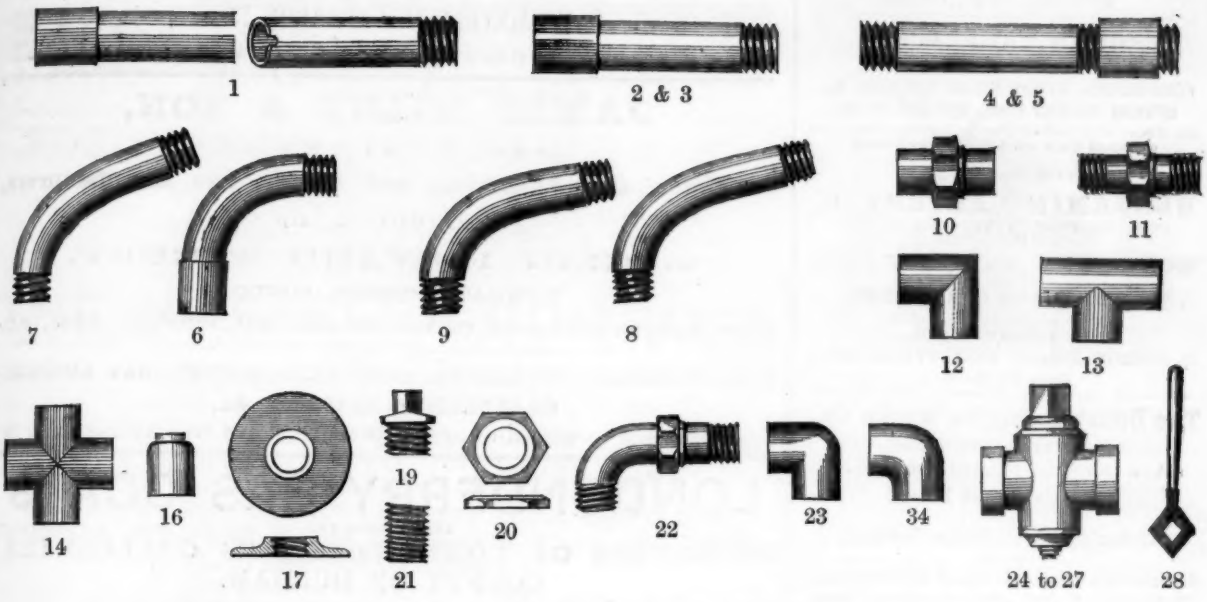

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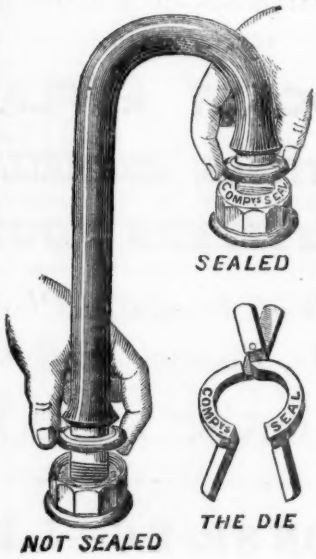

These Unions practically place a Gas Company's property under lock and key, by rendering it impossible to disconnect at any joint at which gas could be obtained unregistered, without destroying the Company's seal or signature, whilst a small cover absolutely protects the impression from accidental injury.

A meter having been fixed with one of these Unions on the main-cock, and another on the inlet, a few pinches of specially prepared crushed sealing-wax is placed in the cup, and being melted with a blow-pipe, the wax runs between the reversed threads, the circular tong-shaped die will then give a sharp impression of the Gas Company's title, an operation requiring about two minutes in all to perform.

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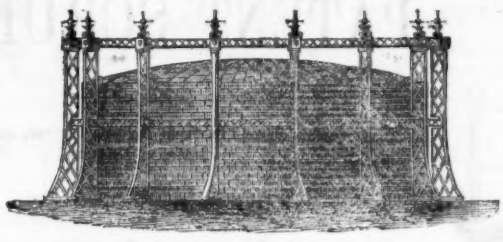

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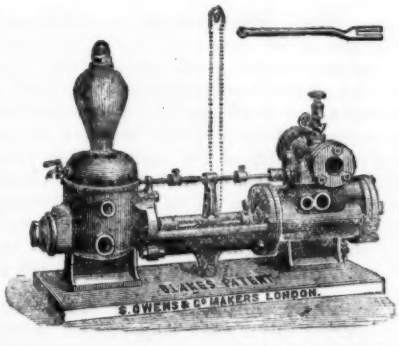
It will start at any point of stroke.

It has no dead point.

It works fast or slow, with the same certainty of action.

It is economical. Has a lead on the slide-valve.

It is compact and durable.



It is interchangeable in all its working parts.

It will deliver more water than any other pump.

It is made of best materials in the most workmanlike manner.

Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

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IMPROVED PATENT GAS-VALVES.

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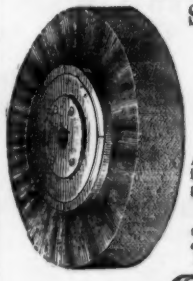

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,, 9, ,,	12in.	block,	7	,,	10	,,	180s.	,,
,, 10, ,,	16	,,	7	,,	10	,,	228s.	,,
,, 11, ,,	12	,,	4	,,	4	,,	54s.	,,
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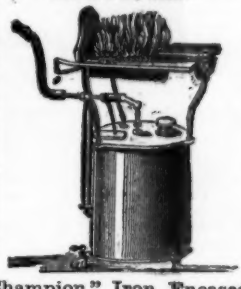
Wheel,	6in.	dia.,	2¼	wide,	1¼	wire projects,	5	rows,	⅜ hole, 10s.
,,	8	,,	2½	,,	1½	,,	6	,,	½ ,, 18s.
,,	10	,,	3	,,	2½	,,	6	,,	½ ,, 21s.
,,	12	,,	3½	,,	3½	,,	7	,,	½ 28s. 6d.
,,	14	,,	3½	,,	3½	,,	7	,,	1 36s.
,,	18	,,	4	,,	3½	,,	8	,,	1½ 62s. 6d.

The "Champion" Iron Encased Forges.

Are specially suited for General Outdoor Purposes, and will be found suitable to any climate.



PRICES.

SINGLE BLAST.

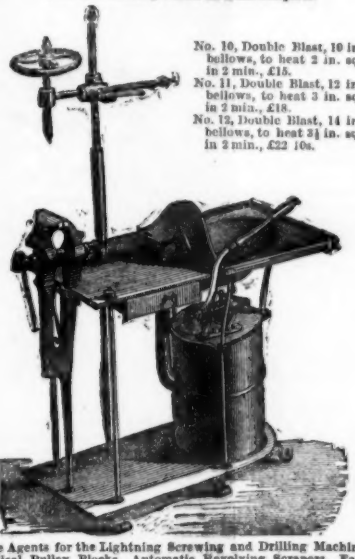
No.		£ s.
1.	8 in. bellows, to heat 1 in. sq. in 3 min.	10
2.	10 in. bellows, to heat 1½ in. sq. in 2 min.	13
3.	12 in. bellows, to heat 2 in. sq. in 2 min.	19

DOUBLE BLAST.

No.		£ s.
4.	10 in. bellows, to heat 1 4th in. sq. in 2 min.	15
5.	12 in. bellows, to heat 2 in. sq. in 2 min.	18
6.	12 in. bellows, to heat 3 in. sq. in 2 min.	22
7.	14 in. bellows, to heat 3½ in. sq. in 2 min.	27

The "Champion" Iron Encased Forge,

With Vice-Drilling Frame on stand complete.



No. 10, Double Blast, 10 in. bellows, to heat 2 in. sq. in 2 min., £15.

No. 11, Double Blast, 12 in. bellows, to heat 3 in. sq. in 2 min., £18.

No. 12, Double Blast, 14 in. bellows, to heat 3½ in. sq. in 2 min., £22 10s.

Sole Agents for the Lightning Screwing and Drilling Machines, Helical Pulley Blocks, Automatic Revolving Scrapers, Earth Borers, Tanite Co.'s Emery Wheels and Emery Grinders, Lathes, Genuine Morse Twist Drills, Cushman's Drill and Lathe Chucks, Patent Belt Screws, Patent Safety Belt Shippers, Casting Brushes, Shaped Diamonds, and a great variety of other Machinery always kept in stock or in progress.

LAMBETH HILL,

Queen Victoria St., London, E.C.

C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

R. DEMPSTER AND SON'S

WOOD SIEVES FOR PURIFIERS,

WITH TAPER OR PARALLEL BARS,

MADE BY SPECIAL MACHINERY.

SCRUBBERS FILLED WITH BOARDS,

On our approved principle, for the extraction of Ammonia.

Prices on application. References to First-Class Engineers.

ROSE MOUNT IRON-WORKS,

ELLAND, Near HALIFAX.

London Offices: 2, SUFFOLK LANE, CANNON STREET, E.C.

GAS *v.* ELECTRIC LIGHT.

WIGHAM'S PATENT GAS-BURNERS

FOR

STREET LIGHTING, &c., WHICH REQUIRE NO GLASS CHIMNEY.

Speaking of these burners, erected on the Thames Embankment, the Governor of The Gaslight and Coke Company, at the half-yearly meeting, Aug. 15, 1879, says:

"Any gentleman who may wish to see the light, may do so at the foot of Westminster Bridge, where it is in direct contiguity with the electric light, so that he will be able to judge for himself. There is a light there that completely excels the electric light in the intensity of its illumination, and in the scope of its diffusion. The lamps on Westminster Bridge are some of Mr. Wigham's."

SOLE MANUFACTURERS:

J. EDMUNDSON & CO., GAS ENGINEERS,

19, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.

J. & J. BRADDOCK,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY CONSUMERS GAS-METERS,

OF THE HIGHEST EXCELLENCE ONLY;

ROUND STATION-METERS,

ON CAST-IRON STANDS;

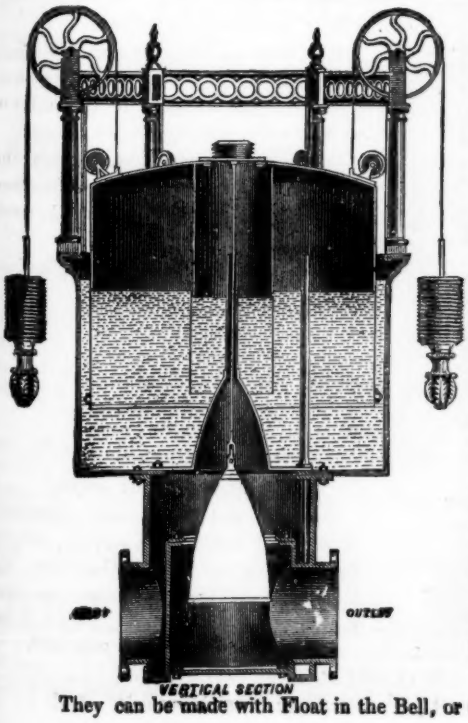
SQUARE STATION-METERS,

WITH PLANED JOINTS.

Messrs. Braddock beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 30-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

HENRY LYON (14 years Engineer and Manager of the largest of the Manchester Corporation Gas-Works) Mechanical and Consulting Gas Engineer, reports upon the condition and value of Gas-Works, supplies plans and specifications of all Apparatus appertaining to Gas-Works, and re-models existing Works.

Address Northenden Road, Sale, Cheshire.

SANDELL AND SON,

PUBLIC ACCOUNTANTS,

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Sandell and Son having been engaged during the last 25 years in Gas Companies Accounts, either in Preparing or Investigating Statements for Parliamentary Applications, Arbitrations, and otherwise, offer with confidence their Services for similar purposes.

Mr. ROBERT DEMPSTER,

CONSULTING GAS ENGINEER,

ELLAND, near HALIFAX,

May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations is both extensive and reliable.

W. LIDDALL,

Public Accountant,

MOORGATE STREET CHAMBERS,

GREAT SWAN ALLEY,

MOORGATE STREET, E.C.

ALFRED LASS, F.I.Accts.,

SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,

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Accounts Analysed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

HARPER & MOORES,

PROPRIETORS OF THE

BEST STOURBRIDGE CLAYS,

STOURBRIDGE.

Manufacturers of all Descriptions of

BEST STOURBRIDGE FIRE-BRICKS, LUMPS, AND CLAY RETORTS

Of all Dimensions for Gas-Works,

GLASS-HOUSE POTS & CRUCIBLES

Established 1836.

The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture. Silver Medal, Paris, 1878.

TO MAKERS OF SULPHATE OF AMMONIA AND BUYERS OR SELLERS OF GAS LIQUOR.

F. SUTTON & CO., Norwich, are now prepared to Supply a Set of Apparatus with Standard Test Solutions for the rapid and accurate analysis of Gas Liquor, which can be used by any intelligent workman, so as to show the actual amount of Sulphate which can be got out of any sample of liquor in a few minutes, without any of the annoyance arising from saturation with acid, &c. Tables are also given, showing the quantity of acid of various strengths required for any given liquor, the accurate ounce-strength and percentage of pure ammonia, &c. Price of the set, with full direction and table (copyright), with materials sufficient for fifty analyses, £4 4s.

Post orders or cheques to be made payable to F. Sutton and Co., Manufacturing Chemists, Norwich, who also supply every description of Standard Solutions for Volumetric Analysis of Waters, Beers, Manures, &c., of guaranteed accuracy.

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WILLIAM MacLEOD & Co.,

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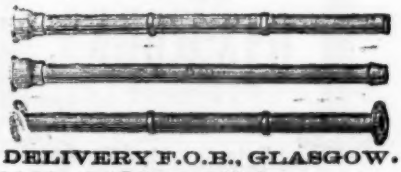
CAST-IRON GAS AND WATER PIPES.



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Prices on application.

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SHOTT'S BOGHEAD.

HARTHILL CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

THRASHBUSH CANNEL

12,530 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,100 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERSPOON, FERGUSON AND Co., 21, Lime Street, LONDON, E.C.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

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GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12¼ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

THE

SILICA FIRE-BRICK CO.,

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Near SHEFFIELD,

Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET, DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

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All negotiations respecting M. Brémond's patented process for preventing Deposits of

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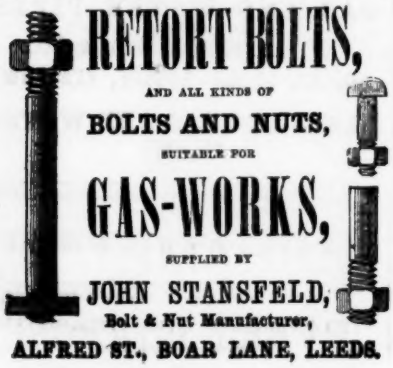

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AND ALL KINDS OF

BOLTS AND NUTS,

SUITABLE FOR

GAS-WORKS,

SUPPLIED BY

JOHN STANSFELD,

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GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

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WESTMINSTER, S.W.,

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RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

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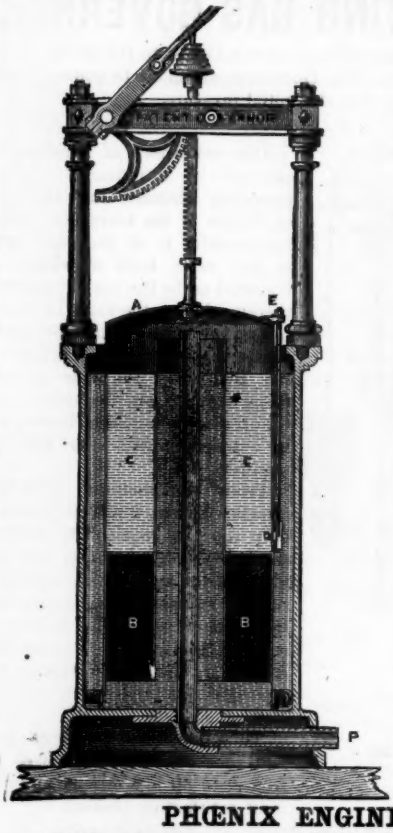
GEORGE WALLER & CO.,

GAS AND HYDRAULIC ENGINEERS,

Patent Compensating Steam Governor,

WITH SELF-CONTAINED WATER-BALANCE.



This is the most efficient and perfect Governor yet made to control and regulate the speed of Engines and Exhausters according to the varying make of gas, and maintain a steady gauge, whether working level or with six inches of seal.

It is the only Governor that will effectually control Condensing and Compound Engines, especially when the Exhauster is on light work, and the Engine is large.

During the drawing and charging of Retorts, the Engine requires no attention—a matter of great importance in small works.

Descriptive Circular sent on application.

They are in use at

BECKTON,
HAMPTON WICK,
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HARTLEPOOL,
RAMSGATE,
SUTTON,

and about 30 other works.

G. W. and Co. make **special Steam Throttle Valves,** suitable for working with this Governor, and alter existing Throttle Valves to same plan.

See also advertisement, page 598.

PHŒNIX ENGINEERING WORKS,

Holland Street and Bear Gardens, Southwark, S.E.

PARIS EXHIBITION, 1878.

THREE MEDALS
AND
HONOURABLE MENTION
HAVE BEEN AWARDED TO
JOSEPH CLIFF & SONS
For their Various Exhibits, amongst which is a
SILVER MEDAL
FOR THEIR
PATENT MACHINE-MADE
RETORTS AND FIRE-BRICKS,
Being the Highest Honour given for this class.

Established

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JOSEPH CLIFF & SONS,
THE ORIGINAL
WORTLEY FIRE-BRICK WORKS,
NEAR LEEDS,
London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

SAMUEL CUTLER & SONS,
CONTRACTORS FOR GAS & WATER WORKS, GENERAL ENGINEERS, IRONFOUNDERS & MANUFACTURERS OF
GASHOLDERS, TANKS, PURIFIERS,
SCRUBBERS, VALVES, EXHAUSTERS, IRON ROOFS, BRIDGES, BOILERS, AND GENERAL CAST AND WROUGHT IRON WORKS.

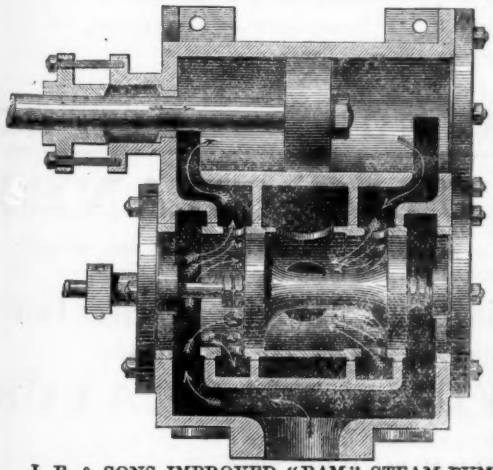
S. C. & SONS undertake the entire erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the supplying and laying of MAINS.
They make a speciality of supplying every requisite whatever for Gas-Works, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.
SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

Manufacturers of MORRIS & CUTLER'S PATENT CONDENSER & CUTLER'S PATENT GAS-WASHER.

DESCRIPTION OF MORRIS & CUTLER'S PATENT CONDENSER.—The Condenser may consist of pipes arranged in tiers, or in any other form most convenient to the site available, each tier being connected with special connections, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. The Condenser itself may form the support for a high-level cistern. By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control. The Condenser may be seen in operation at the Brentford Gas-Works.

For further Particulars, apply to Mr. F. MORRIS, GAS-WORKS, BRENTFORD, or to S. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.

THE "RELIABLE" STEAM-PUMP
IS NOW IN USE AT NEARLY ALL THE
LEADING GAS AND CHEMICAL WORKS THROUGHOUT THE KINGDOM,
INCLUDING
THE GASLIGHT AND COKE CO., BECKTON NEW WORKS (24 supplied),
THE GASLIGHT AND COKE CO., GREAT CAMBRIDGE STREET WORKS, HACKNEY,
THE PHŒNIX GAS CO. and COMMERCIAL GAS CO., LONDON,



BIRMINGHAM, LEEDS, BLACKBURN, NOTTINGHAM, CARLISLE, COVENTRY, DERBY, EXETER, LICHFIELD,

BRISTOL, BRADFORD, WOLVERHAMPTON, JERSEY, TUNBRIDGE WELLS, RICHMOND, STRATFORD, DUDLEY, and other Gas-Works.

The "RELIABLE" is undoubtedly, by means of its Piston Valve, the best Pump made for Gas-Works use. It is specially adapted for pumping TAR, OILS, AMMONIACAL LIQUOR, &c., and is the ONLY Pump that will do so SUCCESSFULLY and at the same time discharge double the quantity of liquid. The "RELIABLE" is the only Pump manufactured that is REVERSIBLE, and therefore is invaluable in frosty weather.

J. E. & SONS IMPROVED "RAM" STEAM-PUMPS, which are made with both Single and Double Rams and Steam Cylinders, are also admirably adapted for Gas-Works use.

For Price Lists and Testimonials, apply to the Sole Makers and Patentees,
JOSEPH EVANS & SONS, WOLVERHAMPTON,
MAKERS AND PATENTEES OF
PUMPS AND PUMPING MACHINERY FOR EVERY PURPOSE.

NEW PATENT WET GAS-METER,

THE "RELIANCE,"

MANUFACTURED BY THE

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON; UNION STREET. OLDHAM; HANOVER STREET, DUBLIN.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

GAS-METER COMPANY, LIMITED,
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ALEXANDER WRIGHT & CO.,

MANUFACTURERS OF

"WET" AND "DRY" GAS-METERS,

STATION-METERS, AND GOVERNORS.

METERS, BOXES, REGULATORS, AND ALL REQUISITES FOR PUBLIC LIGHTING.

TESTING APPARATUS for all purposes relating to Gas, &c.

MR. VERNON HARCOURT'S COLOUR TESTS,

Descriptive particulars, per post, 2d.

55, 55a, & 56, MILLBANK STREET, WESTMINSTER,
LONDON, S.W.

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW.

Manufacturers of

CONSUMERS IMPROVED WET GAS-METERS,

THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges,
Governors, Test Holders, &c., &c.

LONDON OFFICE:

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IMPROVED HYDRAULIC CRANES,

Effecting a great saving in the cost of discharging Coals from Vessels, Barges, &c. Several of these Cranes, with the necessary power, are now being erected at Beckton, Hull, and other Gas-Works.

HYDRAULIC APPARATUS for Lifting and Lowering Purifier-Covers.

Sixteen recently erected at Beckton, applied to Covers 30 feet square.

SULPHATE OF AMMONIA APPARATUS,

IN SUCCESSFUL OPERATION AT THE NEW WORKS OF THE NEWCASTLE AND GATESHEAD GAS COMPANY,
AND IN COURSE OF ERECTION AT THE CARLISLE CORPORATION GAS-WORKS.

Special "REGULUS COCKS" manufactured to stand Acid.

FOR PARTICULARS, APPLY TO

JOHN ABBOT & CO., LIMITED,

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London: Printed by WALTER KING, for the Executors of the late WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street), and published by him at No. 11, Bolt Court, Fleet Street in the City of London.—Tuesday, October 14, 1879.